MCM 200

User's Manual

Version 08crs01

Küppers Elektromechanik GmbH

Quality system certified to DIN ISO 9001

Contents

Features and Application

The MCM 200 is a microprocessor-based evaluation unit whith max. two frequency measuring channels, two two analogue measuring channels, two analogue outputs and six switch outputs. As a further option a communication and/or printer interface is available. The operating modes include a measuring mode with monitoring facilities (ratio, real-time flow, preset counter) and a control mode with a PI flow controller.
In accordance with the adjustments and features included the MCM 200 may be used for closed loop control and ratio control. Applications range from simple filling processes to complex 2-component applications (paints, polyurethan etc.).

The MCM 200 distinguishes itself by *short response time*, *high accuracy* and *easy programming* of all parameters via keyboard and VDF-display. Parameters which depend on each other will automatically receive and ideal resolution regarding the hardware. All operating parameters are scaled via foil touch keyboard and a two line VDF-display.

The basic unit has one frequency measuring channel, six switch outputs and one 1:1 frequency output (for additional evaluation units). The basic unit also includes a reverse flow detection.
Universal input stages allow for connection of active and passive pickups, anlogue in- and outputs can use current signals (0/4–20 mA) and voltage signals (0/2–10 V). Further options and adjustments will provide an ideal process adaption.

Operating Principle

An edge-controlled pulse width measurement combined with programmable time-base function provides rapid and stable measuring values. The MCM 200 therefore detects any alteration of the measured values quickly and most accurately.
The analogue inputs incorporate an integrating sigma-delta-converter to ensure that analogous measuring values are detected as accurately (16 Bit) and quickly as required by automatic control applications of process technology.
The analogue output has resolution of 12 bit. It either supplies a standardised analogue signal or serves the PI controller.

Operation and Display

Thanks to clearly laid out parameter sections and a user guide programming the MCM 200 is eased by. There are two programming sections for setup and parameters. Setup includes basic adjustments like operating mode, offset, limit adjustment etc. Usually these adjustments are only required when starting up the MCM 200 or when the whole system is adapted.
The programming of operational parameters like limits or display scaling is functionally divided. All values may be entered and displayed immediately. Units can be selected from presets (l/min, ccm/min ...) and conversions are superfluous. All adjustments may be saved for up to 10 years by an integral battery.

The VFD-display will show present process state. The measuring mode offers various diplays (scaled real-time flow values, limit state, measured frequency, counts etc.). selectable via keyboard

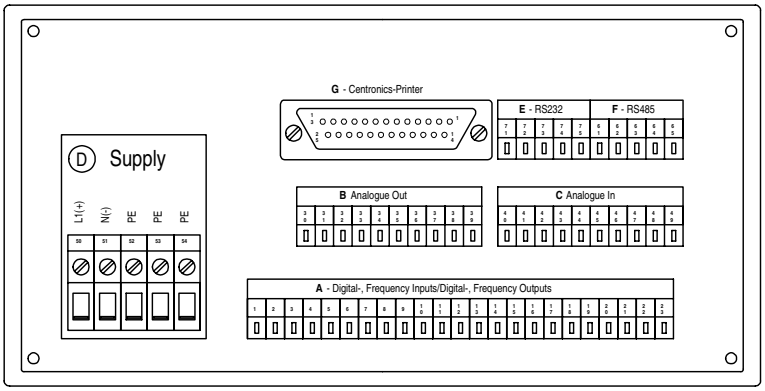
Options

A 2nd frequency measuring channel, linearisation for frequency measuring channel (per channel), PI closed loop controller (per channel), analogue input (per channel), analogue output (per channel), communication and printer interface (per unit).

Technical Data

protection class	front: IP60 according to DIN 40050 rear: IP30 according to DIN 40050
connections	power supply: 3-pin screw terminal, 0.2–2.5 mm² in- and outputs: plug-in screw terminals, 0.08–2.5 mm² interface: plug-in screw terminals, 0.08–2.5 mm²
housing	DIN-panel mount housing 144 mm x 72 mm overall depth including plug: 220 mm
allowable ambient temperature	0 up to +45 °C
weight	approx. 750 g
power supply	230 V AC/50 Hz or 24 V DC power consumption: 5 VA
battery lifetime	with storage 8 years, with daily 8-h-operation at least 10 years
pickup supply	12 V DC/20 mA each channel
frequency inputs	channel A (optionally channel -B-) 2 frequency inputs each channel (one input for measurement, one input for reverse flow detection); accuracy: 0.02% current switch level: NAMUR DIN 19234 voltage switch level: Ul < 6 V, Uh > 9 V, Umax = 30 V
frequency measuring range	0.8 Hz–10 kHz
control inputs	/reset and /hold each channel, /ST1, /ST2, /ST3: active with Ul < 3V (tmin = 100ms) vs. GND
analogue inputs	1 each channel with 14 bit resolution, meas. process sigma-delta. selectable current (0/4–20 mA): input resistance 500 Ohm voltage (0/2–10 V): Ri = 10^{12} Ohm detection of line breakage at 4 mA and 2 V respectively
analogue outputs	1 for each channel, 12 bit resolution current (0/4–20mA), impedance: 1000 Ohm voltage (0/2–10 V), load < 3 kOhm linearity: 0.05 % of final value temperature drift: 0.05 % per 10 K residual ripple: 0.05 % of final value
switch outputs	6 galvanically free, related after setup open collector, 30 V/50 mA, low inductive switch hysteresis adjustable from 0–9.9 % of measured value
frequency output 1:1	1 each channel; galvanically free: open collector 30 V/50 mA
operation and display	front panel: all operation parameters are entered via foil touch keyboard display: two line, type vacuum flourescent display (2 x 20 characters, character size 2.4 x 4.7 mm)
interface RS232/RS 485	serial communication interface 2400/4800/9600 Bd (read/write)
centronics printer interface	parallel line printer to print out measuring values and parameter adjustments (centronics standard)

Rear Terminals (rear connections)



Terminal -A- Digital Inputs

no.	*description*
1	+12 V/20 mA external, pickup supply
2	GND, 0 V external, pickup supply
3	f_{in} channel -A- measurement
4	/f_{in} channel -A- reverse flow
5	f_{in} channel -B- measurement
6	/f_{in} channel -B- reverse flow
7	f 1:1 frequency out channel -A- 1:1, OC
8	f 1:1 frequency out channel -B- 1:1, OC
9	COMMON f1:1 freq. out c hannel-A-,-B-
10	/reset channel -A- (vs. GND)
11	/hold channel -A- (vs. GND)
12	/reset channel -B- (vs. GND)
13	/hold channel -B- (vs. GND)
14	limit -1- , open collector
15	limit -2- , open collector
16	limit -3- , open collector
17	limit -4- , open collector
18	limit -5- , open collector
19	limit -6- , open collector
20	COMMON LIMIT
21	/total reset (vs. GND)
22	/ratio, /limit wait (vs. GND)
23	/prog. lock (vs. GND)

Terminal E RS232 Interface

no.	*description*
71	TxD (send)
72	RxD (return)
73	R-COM (reference mass RS 232 galvanically free)
74	COM print
75	/print

Terminal D Supply

no.	*description*
50	L1 (+) supply
51	N (–) supply
52	PE protected earth
53	PE protected earth
54	PE protected earth

Terminal -B- analogue outputs

no.	*description*
30	I+ current out channel -A- (0/4–20 mA)
31	I- current out channel -A- (0/4–20 mA)
32	PE/protected earth
33	U+ voltage out channel -A- (0/2–10 V)
34	U- voltage out channel -A- (0/2–10 V)
35	I+ current out channel -B- (0/4–20 mA)
36	I- current out channel -B- (0/4–20 mA)
37	PE/protected earth
38	U+ voltage out channel -B- (0/2–10 V)
39	U- voltage out channel -B- (0/2–10 V)

Terminal C analogue inputs

no.	*description*
40	I+ (+24 V) current in channel -A- (0/4–20 mA)
41	GND voltage in channel -A-
42	U+ voltage in channel -A- (0/2–10 V)
43	I current in channel -A- (0/2–10 V)
44	PE/protected earth
45	I+ (+ 24V) current in channel -B- (0/4..20mA)
46	GND voltage in channel -B-
47	U+ voltage in channel -B- (0/2..10V)
48	I current in channel -B- (0/2..10V)
49	PE/protected earth

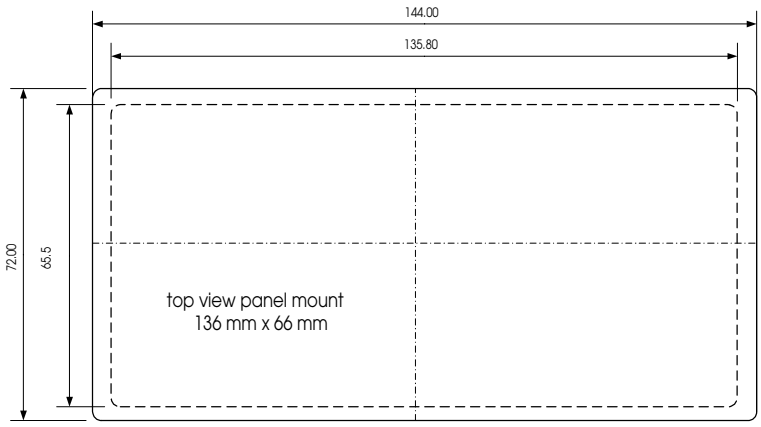
Terminal F RS485 Interface

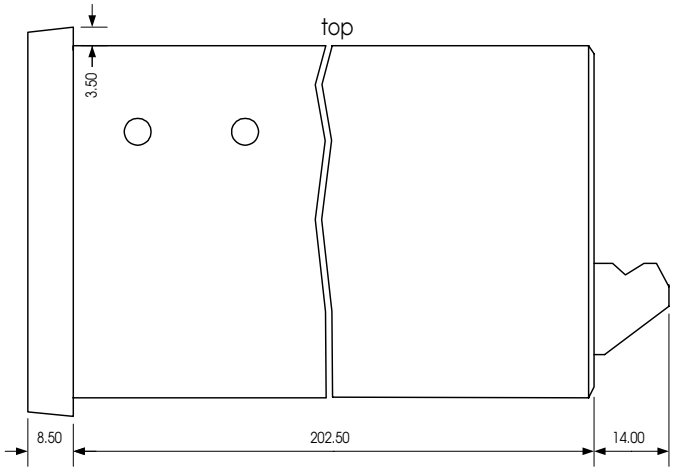
no.	description
61	/TxD (send)
62	TxD (send)
63	/RxD (return)
64	RxD (return)
65	R-COM (reference mass RS485 galvanically free)

Terminal G Centronics Printer (25 D Sub female)

no.	*description*
1	/strobe
2–9	D0...D7
11	busy
16–25	GND printer (galvanically free)

Dimensional Drawing for installation (mm)





Consider bending radius of connector cable for installation.

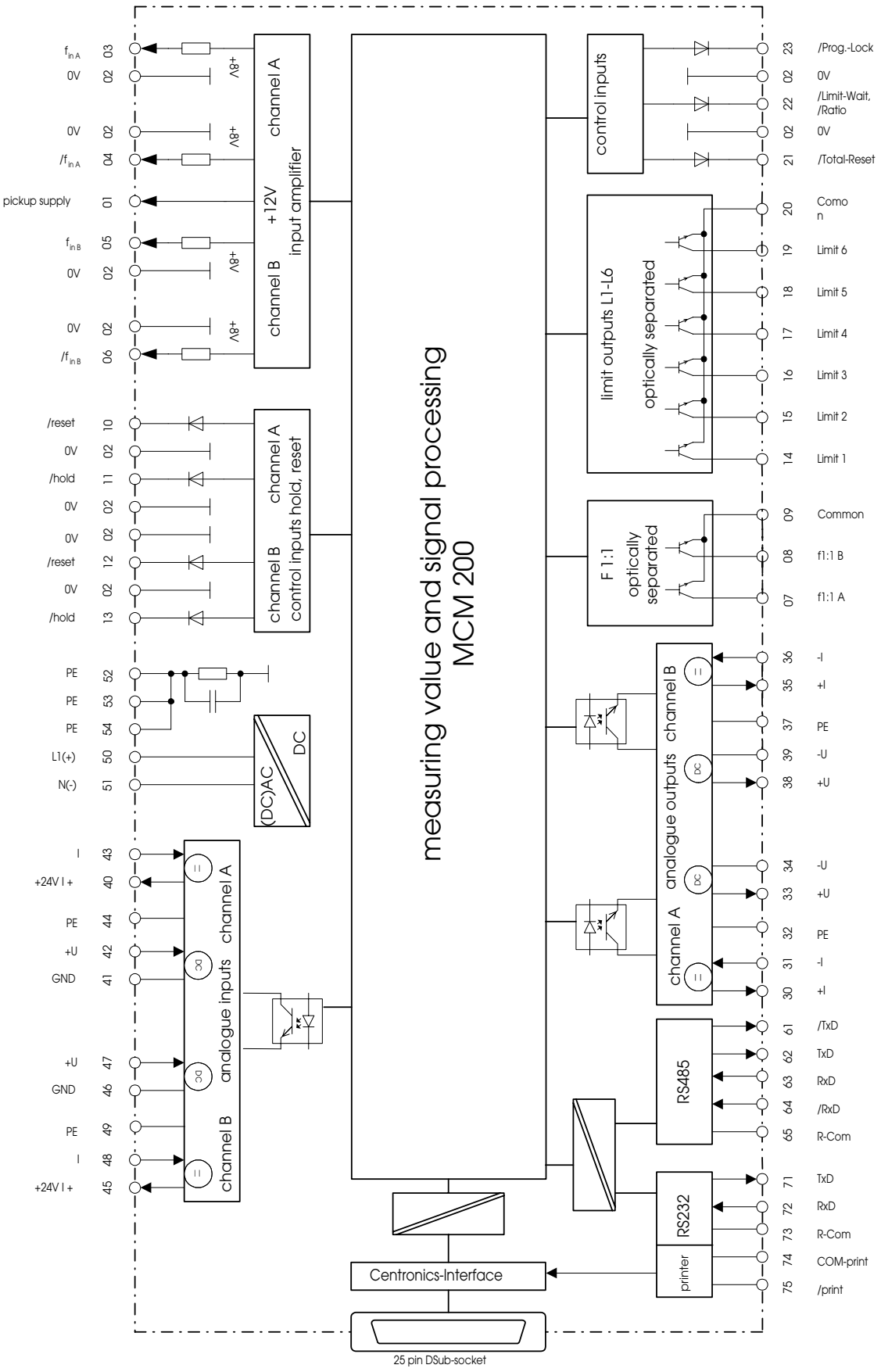
General advice on installation

Connect metal housing with PE.
Built-in devices have to be installed in a metal housing connected with protected earth.
Observe a low impedance connection of PE and a measurement of the PE resistor according to VDE 0701. Also observe a sufficient shielding for the employed cabinet.

Keep distance.
Keep current-carrying cables at least 30 cm away from the MCM 200. Only shall indicated terminals and contacts be used for power supply. Keep mobiles, ISM-units or switching inductivities like engines or solenoid valves at least 2 metres away from the digital measuring and control electronics. Avoid sources of electrostatic charges in the closer environment of the MCM 200. Operators should also consider appropriate clothing and wear of shoes with discharging ability.

Avoid parallel arrangement of current-carrying cables.

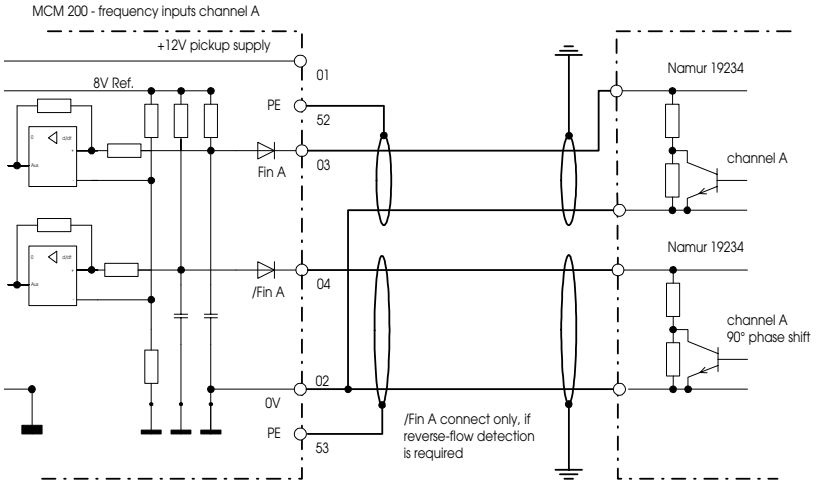
Wiring diagram (rear panel)



Electrical Connection of Outputs and Inputs

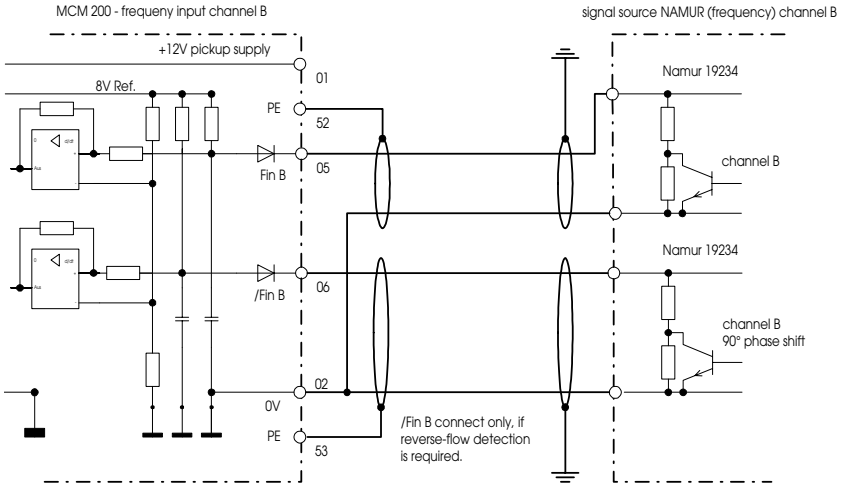
Frequency inputs (general)
The universal frequency input stages of the MCM 200 are suitable for pickups with a NAMUR output or any output which is in line with the allowed levels (cf. "Technical Data", p. 3). Terminal 01 provides a pickup supply of +12 V, max. 50 mA.

Frequency input measuring channel A
Both measuring channels have second input which is required for reverse flow detection.
The flow or rotational direction is detected by a 90° phaseshift of Fin A or Fin B respectively. The second input is complementary and cannot be used for measurement.



Frequency input measuring channel B

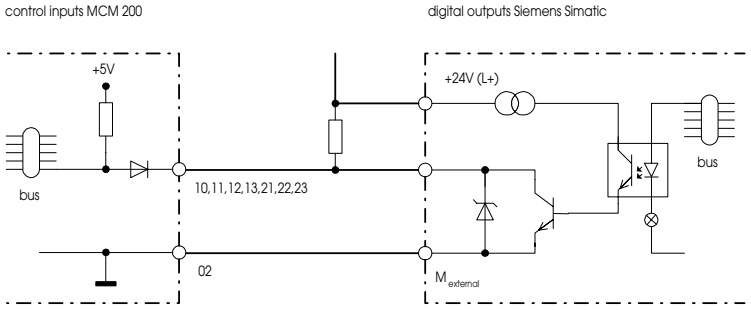
Spefications as above.



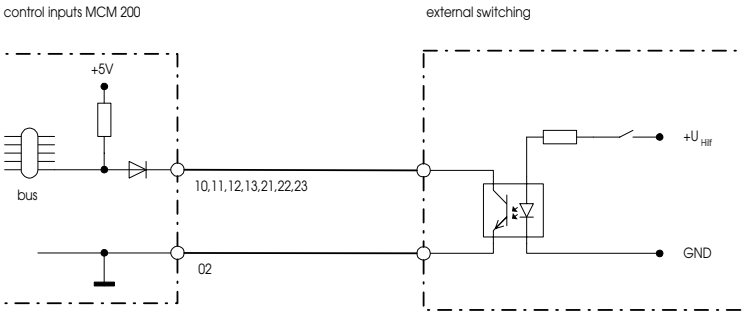
Control inputs

The MCM 200 has two kinds of control inputs: The examples below show that /reset and /hold will refer to the individual channels while /limit wait, /total reset and /ratio will influence the general performance of the MCM. Die Eingangsbeschaltung ist für alle Steuereingänge gleich.

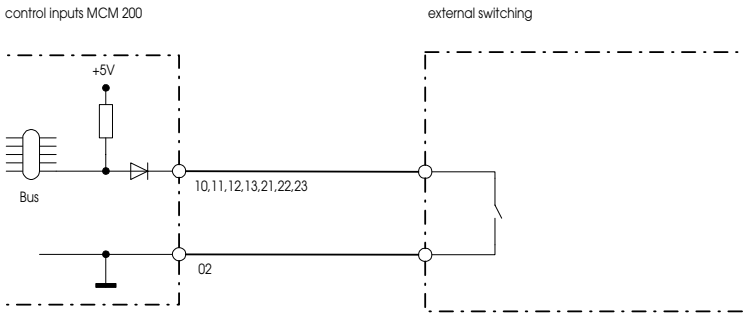
Driven by PLC (Siemens Simatic)



Driven by external optocoupler



Driven by potential free contact

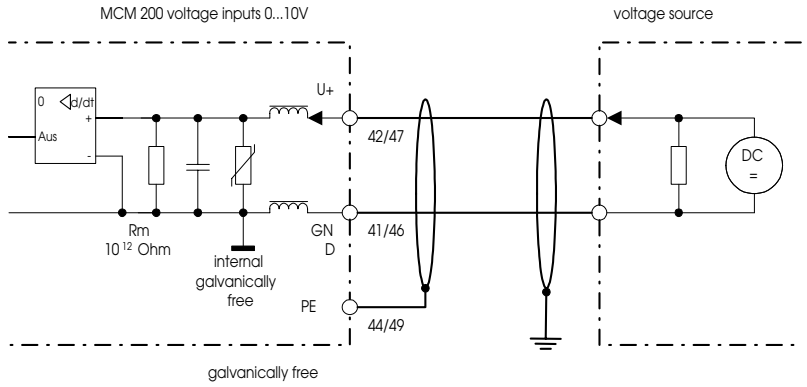


Analogue Inputs

The MCM 200 can be equipped with max. two analogue inputs, which may be used as a measuing input or as a setpoint input for the PI controller. They are suitable for voltage (0/2–10V) or current signals (0/4–20mA).

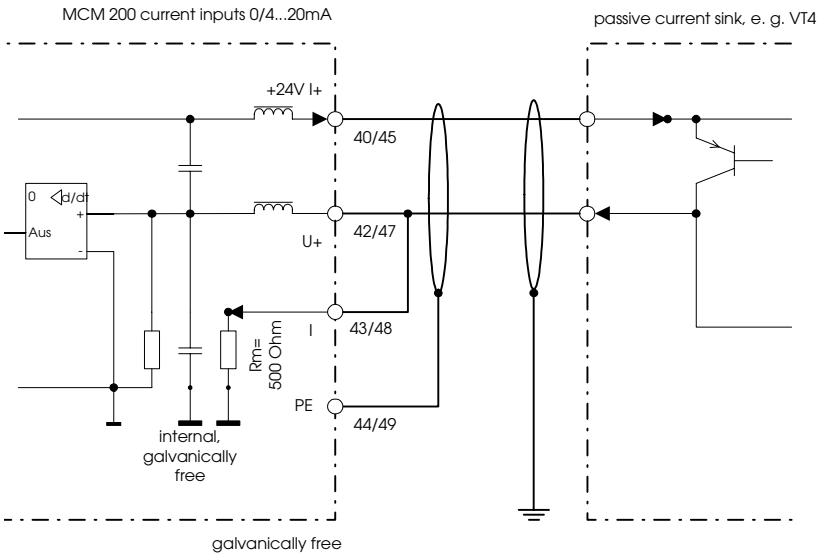
Voltage inputs (0/2–10 V)

The voltage inputs have a common potential (GND), however, the are electrically isolated from all other inputs and outputs.



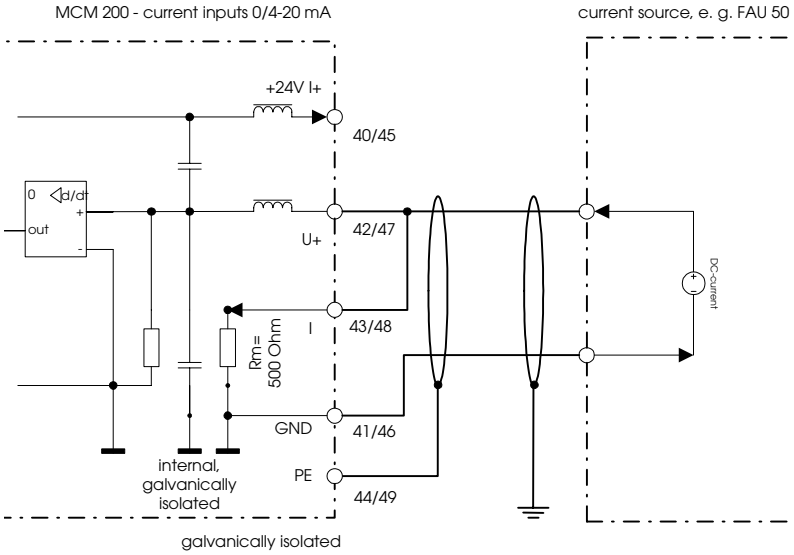
Current inputs – passive current sensors (4–20mA)

Like the voltage inputs, the current inputs have a common potential and are electrically isolated from all other in- and outputs. The diagram below shows a connection with a passive current sink, i. e. the sensor is powered by the MCM 200 (4mA). Adding the signal current of max. 16mA will result in a total measuring current of 20mA.



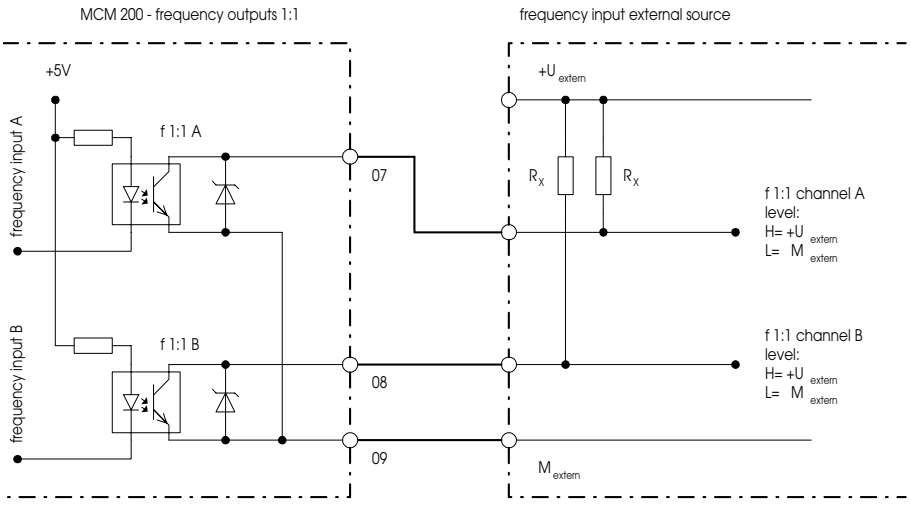
Current inputs – active current sensors (0/4–20 mA)

The diagram below shows the connectio of an current sensor (e. g. KEM's FAU 50, frequency to analogue converter). Such sensors do not require external supply.



Frequency output (1:1) channel A and B

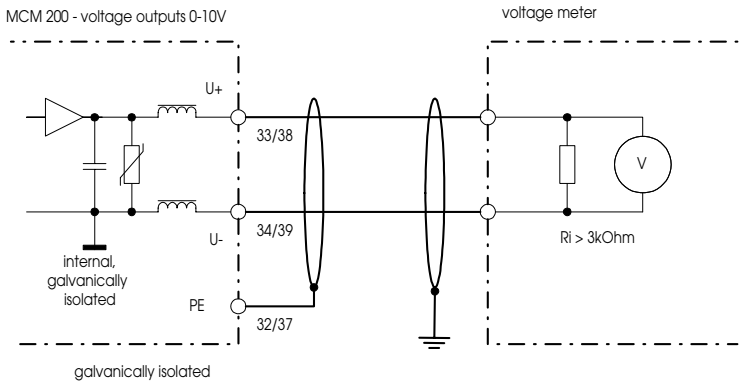
The original input frequency of terminals F_{in} A and F_{in} B is available as a galvanically free open collector signal for further processing by additional evaluation units. External resistor networks can provide any level whatsoever.



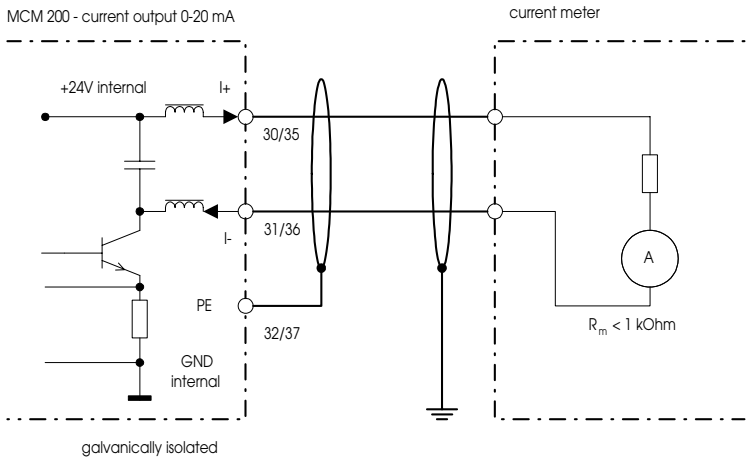
Analogue outputs

Each measuring channel has an analogue output supplying 0/2–10 V and 0/4–20 mA. Voltage and current signal are available at the same time and can be scaled freely or be used to drive the PI controller.
The analogue outputs are electrically isolated from each other and from all other reference potentials.

Voltage output 0/2–10 V



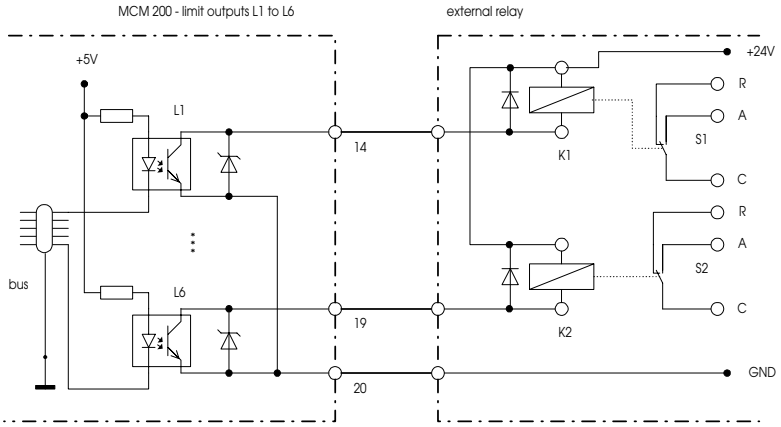
Current output 0/4–20 mA



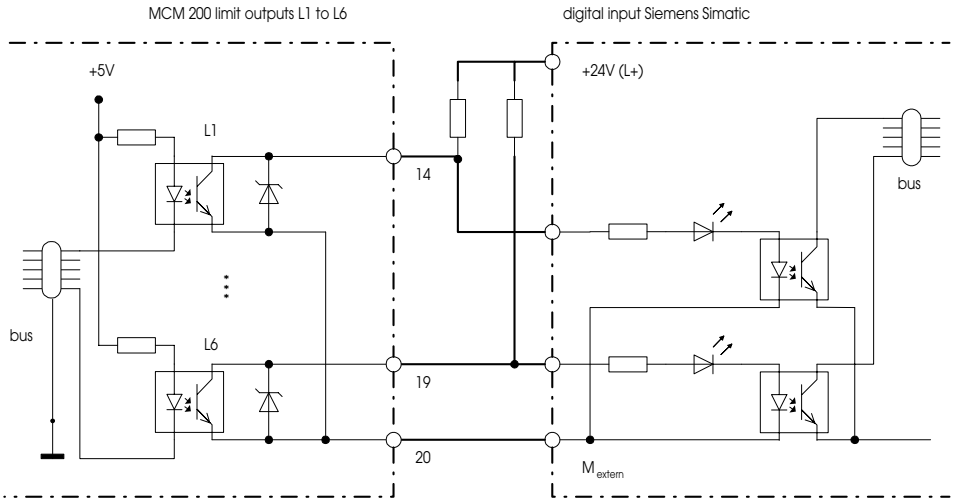
Limit outputs

The basic unit of the MCM 200 includes 6 switch outputs which can be related to the operating values. These outputs have a common potential and are galvanically separated from the reference potentials of all other in- and outputs. Here are some examples of how to connect the limit outputs:

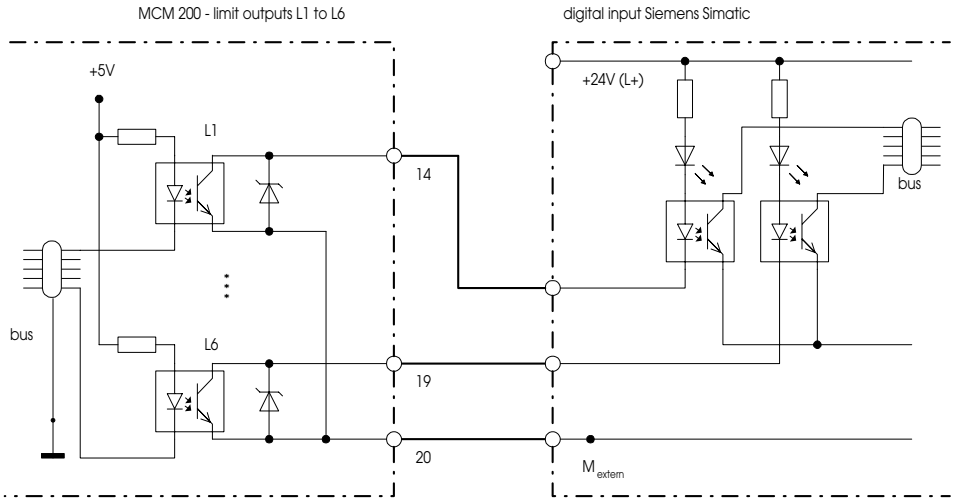
Operation with an external relay



Operation with PLC inputs (inverse)



Operation with PLC inputs

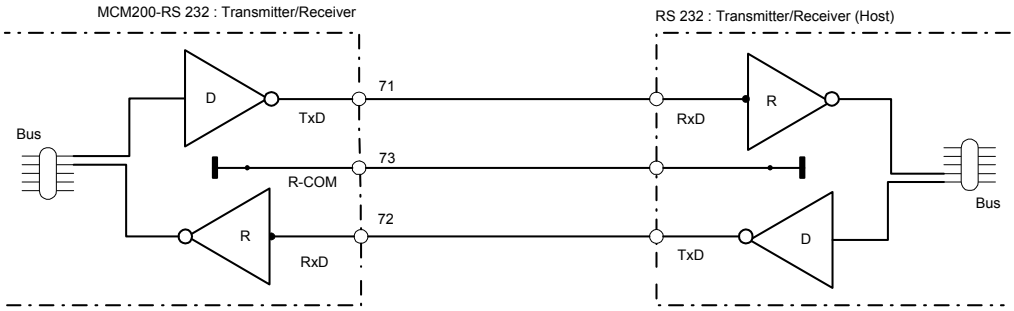


Combining the open-collector-outputs with external resistor networks (cf. »frequency outputs 1:1«, p. 12) will provide any level which may be required by existing inputs.

Communication Interface RS 232/RS 485

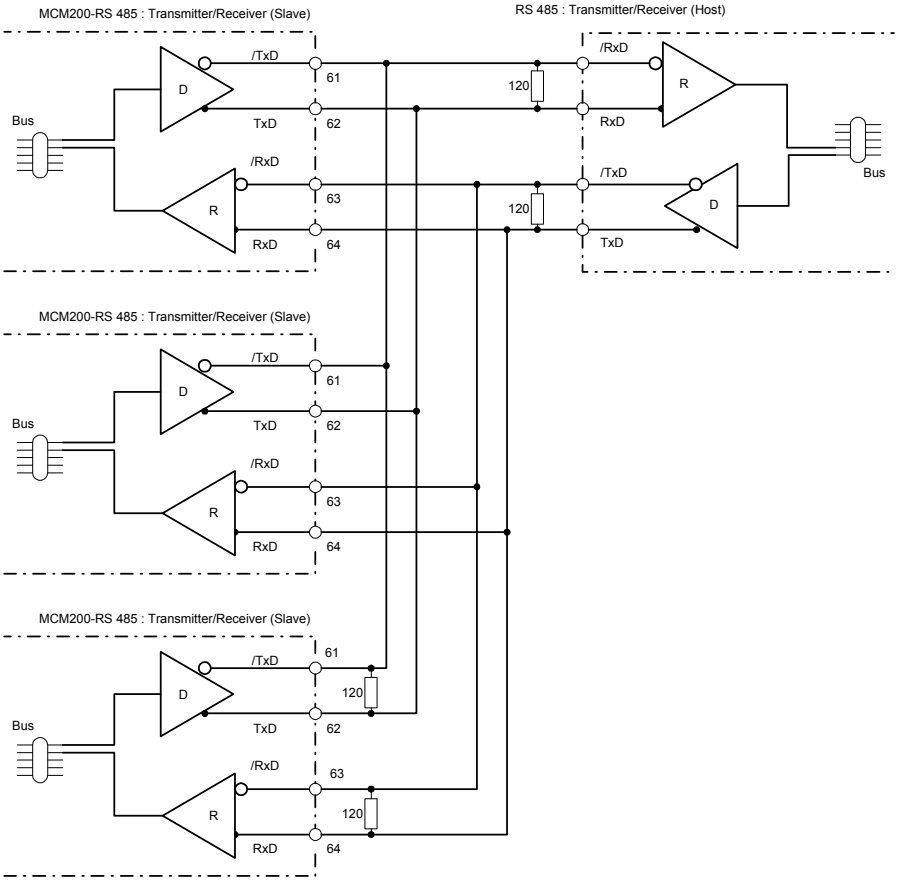
The MCM 200 may optionally be equipped with a serial communication interface.
Two types are available: RS 232 and RS 485 each with an individual 10pin screw terminal at the rear.
Both types may be fitted, however, only one can be used at a time.

Operation with an RS232 interface



Operation with an RS485 interface

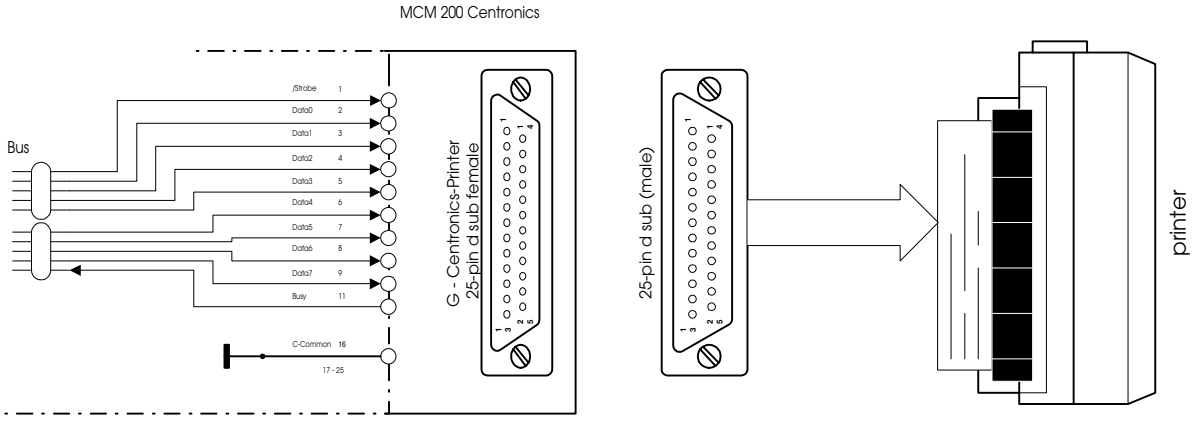
Thanks to the daisy-chain-topology shown here, up to ten MCM 200 units may be operated in a network. The programable module offet allows for numbering and contacting the individual MCM units (cf. programming of RS 485).



Use only »twisted pair« cables. Cable tips should be concluded with resistors accordingly.

Centronics Printer Interface

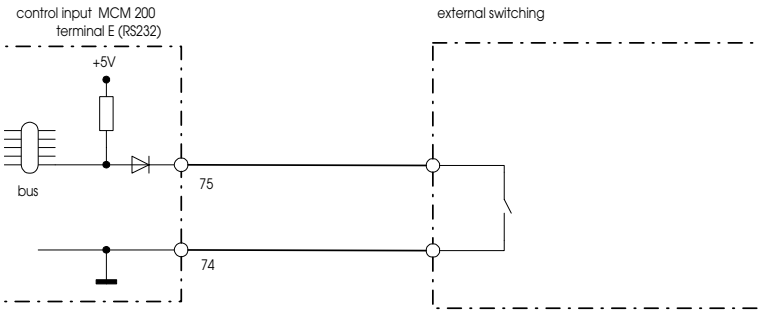
A 25-pin d-sub-socket allows for connection of centronics printers to print out parameters and measuring values. Customary printer cables (PC ➔ printer) may be used. The printer output potential is electrically isolated from all in- and outputs of the MCM 200.



Maximum cable lenght (centronics cable) 1.5 metres.

Printouts

Printouts may be triggered via the MCM keyboard and/or an external contact. Terminal E (RS232) has two pins for this function which may be activated by a potential-free contact or an open collector output.



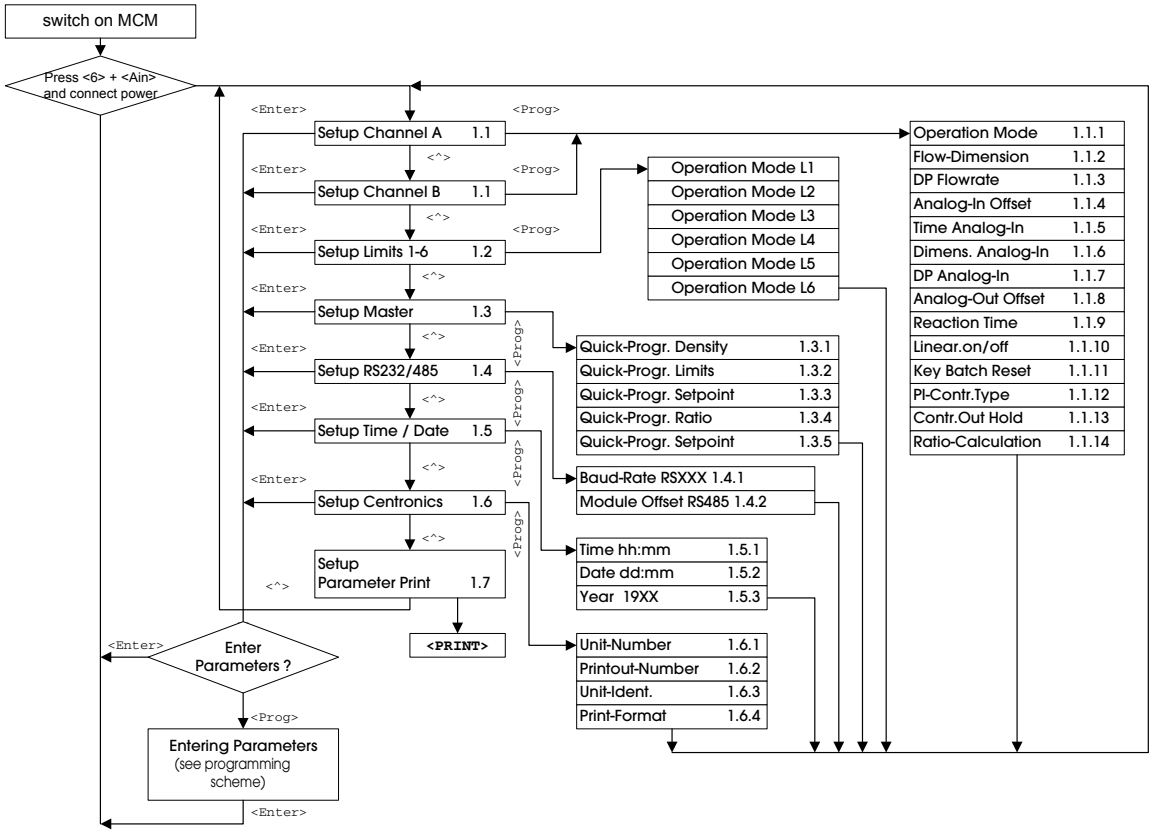
Printouts via MCM keyboard

To print out recorded data in the measuring mode press the PRINT key followed by INFO key.

Setup Menu Structure

The setup requires you to make some basic adjustments in accordance with hardware and software features of the MCM. The setup adjustments are independent of the operation parameters like limits, hysteresis or time and date.

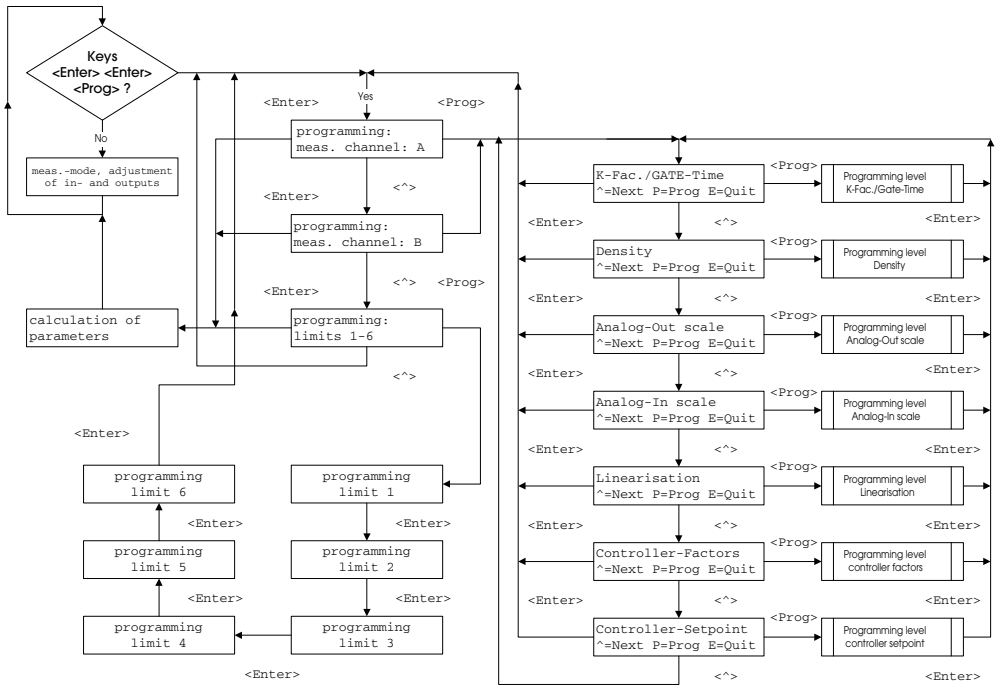
To start up the setup simultaneously press the keys 6 and Ain and connect power afterwards. Wait until the message »Setup Channel A« appears in the display.



Programming Menu Structure

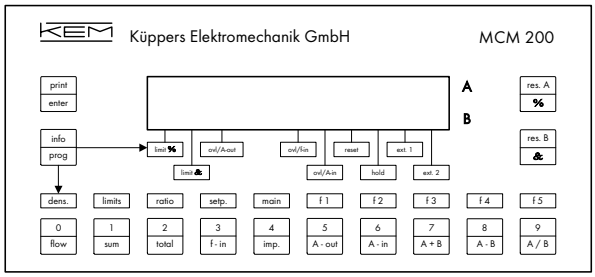
Unlike the setup adjustments, the programming will determine individual parameters in accordance with the measuring task.

To start programming repeatedly press ENTER followed by PROG.



Measuring Mode

Selection of Displays – Representation of Measuring Results



In the measuring mode you may select from various displays pressing one of the bottom keys. The keys have different functions according to the mode selected. With active *measuring mode* the *2nd line* of the key applies, it gives a short description of the display. The capitals A and B on the right to the display represent the two channels. For one-channel versions, please read p. 18 before going on.

Please note

- Some displays require optional features (analogue input, -output, 2nd measuring channel) to be available.
- If the control inputs »HOLD« and »RESET« are connected the following message will appear for one second.

```
_______123.56 l/min__ A        ___HOLD  ACTIVE!____    A
_______056.21 l/min__ B        ___RESET ACTIVE!____    B
```

Keys to select displays (bottom row)

flow key

0 flow

This display shows the scaled measuring results of both frequency channels.
Unit and resolution of the channels depend on the setup adjustments for the corresponding channel. The scaling is determined by the K-factor of the flow meter (to be entered in the setup mode as well), the a. m. unit and resolution as well as by an active linearisation.

```
_______123.56 l/min__ A   channel A:   real time flow in litres per minute
_______056.21 l/min__ B   channel B:   real time flow in litres per minute
```

sum key

1 sum

The MCM 200 has two counters for each channel. The totalizer which is displayed here can be reset externally (batch processes). The totalizer is standardized by the K-factor and unit of the real time value.

```
_______434.12 Liter__ A   sum of channel A in litres
_______089.45 Liter__ B   sum of channel B in litres
```

total key

2
total

The totals counter parallels the a. m. totalizer (total consumption over a longer period, e. g. changing shifts and charges, monthly consumption etc.). This channel can only be reset *for both channels simultaneously* via the external control input (see terminal layout). The totals counter is standardized by the K-factor and unit of the real time value.

_____1567.24 Liter__ A *totals of channel A in litres*
_____567.66 Liter__ B *totals of channel B in litres*

f-in key (alternating function)

3
f–in

To display the »raw« measuring frequencies of both channels with a fixed resolution of 0.01 Hz.
The message »Hz-FAST« tells you that the displayed values have not received any calming or standardizing.
A repeated pressing of this key will call up the the calmed frequency indicated by the message »Hz-Sample«.
The frequencies displayed now are calculated via the programmed measuring time (see GATE-TIME).

_____234.27 Hz-Fast A *raw freq. ch. A* **_____234.27 Hz-Samp A** *calmed freq. ch. A*
_____175.43 Hz-Fast B *raw freq. ch. B* **_____175.43 Hz-Samp B** *calmed freq. ch. B*

imp key

4
imp

To display the unscaled incoming pulses of both channels with their corresponding frequencies.

_____17438045Im3060Hz A *channel A: incoming pulses and corresponding frequency in Hz*
_____19154567Im3126Hz B *channel B: incoming pulses and corresponding frequency in Hz*

A-out key* (alternating function)

5
A-out

To display the state of the analogue output. Two different formats are available which can be called up by repeated pressing of this key.

__123.56 l/min 56.8% A *channel A: scaled real time value and analogue level in percent*
__056.21 l/min 23.5% B *channel B: scaled real time value and analogue level in percent*

----------I--------- A *channel A: trend analogue output*
-----I-------------- B *channel B: trend analogue output*

A-in key*

6
A-in

To display the scaled value of the analogue inputs (e. g. temperature, pressure, flow) in accordance with the way of use (setpoint preset or measuring input).

_____056.23 °C_____ A *channel A: scaled analogue value in °C*
_____047.56 °C_____ B *channel B: scaled analogue value in °C*

* Key works only when respective option is included.

A+B key

7
A+B

To display the sum of the measuring values of channel A and B. As a precondition for this display both channels must have the same units.
The first line starts off »A+B = ... « to avoid confusion with the flow display (cf. page 16).

A+B = 179.77 l/min__ A *scaled sum (total flow) of channel A and B*
_____056.21 l/min__ B *scaled real time value of channel B*

A–B key

8
A–B

To display measuring value of channel A minus measuring value of channel B (for consumption measurement, up- and downstream).
As a precondition for this display both channels must have the same units.
The first line starts off »A–B = ... « to avoid confusion with the flow display (cf. page 16).

A–B = 067.35 l/min__ A *scaled difference channel A–B*
_____056.21 l/min__ B *scaled real time value channel B*

A/B key

9
A/B

To display the ratio of measuring values A and B . As a precondition for this display both channels must have the same units.
The first line starts off »A/B = ... « to avoid confusion with the flow display (cf. page 16).

A/B =_2.198 _____ A *ratio A : B*
_____056.21 l/min__ B *scaled real time value channel B*

info/prog key (located on the left to the display)

info
prog

To display the state of the limits and the three external control contacts as well as errors with serial data transmission.

Limits and external contacts (press INFO/PROG once)
In accordance with the operating values the limits can take the following states: ↑ = exceeding, ↓ = bypassing and 0 = inactive.
Active control inputs are displayed by their respective number 1,2 or 3. Inactive control inputs are represented by »o«.

Example: Limit 3 is exceeded, Limit 6 is bypassed, control inputs 1 and 3 are connected.

Input/L→1 2 3 4 5 6 A *limits 1–6*
_1o3_____0_0_↑_0_0_↓_B *limit state*

state of control inputs

Errors with serial data transmission (press INFO/PROG again)
After repeated pressing of the INFO/PROG key the following table of errors will appear in the display:

Error	Description
No Hex in Module	module number has no valid hex-characters
Module negative	module of previous unit
Next Module	module of next unit
OEER	overflow (baudrate)
FEER	framing error – data format, start and stop bit
OVFL	overflow of internal memory

In order to return to the limit display press INFO/PROG again.

One-Channel Versions

The a. m. description of the displays and keys is based on an MCM 200 which includes all options. If your MCM 200 is a one-channel version, please ignore the capitals A and B on the right to the display and please note you may vary the two lines of the display by your own choice.

Example:

Pressing flow will call up the following display:

_____	*no display*
_____**123.56 l/min**__	*real time flow of channel A in litres per minute*

Pressing sum afterwards will change the display as follows:

_____**123.56 l/min**__	*real time flow of channel A in litres per minute*
_____**434.12 Liter**__	*sum of channel A in litres per minute*

The former bottom line is scrolled up to the top and the current bottom line shows the newly selected display. You may repeat this scrolling effect as often as you like. Press total to change the display as follows:

_____**434.12 Liter**__ ~~**A**~~	*sum of channel A in litres per minute*
_____**1567.25 Liter**__ ~~**B**~~	*totals of channel A in litres per minute*

Starting up the MCM 200

Before you turn on the MCM 200, please note two functions require you to press a certain key before you connect the power cord.

1. Calling up information on the included options

info
prog

Keep key »info/prog« pressed (located on the left to the display)
and connect power cord
The first message in the display is

```
* K E M * -date of manufacture-
Elektromechanik GmbH
```

followed by the system following system information:

```
* MCM-200*_Version      channel A
____no. of channels____ channel B

Analog-Input : Yes__    channel A
Analog-Input : Yes__    channel B

Analog-Output: Yes__    channel A
Analog-Output: Yes__    channel B

PI-Controller: Yes__    channel A
PI-Controller: Yes__    channel B

Linearisation: Yes__    channel A
Linearisation: Yes__    channel B

RS 232/485:    Yes__    channel A
Centronics:    Yes__    channel B
```

options which are not included are marked »No«.

The next message is the following:

```
Calculating ......__    channel A
Work-Register.....__    channel B
```

The MCM is calculating all parameters necessary for operation. Afterwards the last-selected display of the measuring mode appears, e. g. the flow rate display:

```
_______123.56 l/min__
_______056.21 l/min__
```

2. Starting the setup

6
A - in

Keep key »6/A - in« pressed (located in the bottom row below display)
and connect power cord. The first message appears:

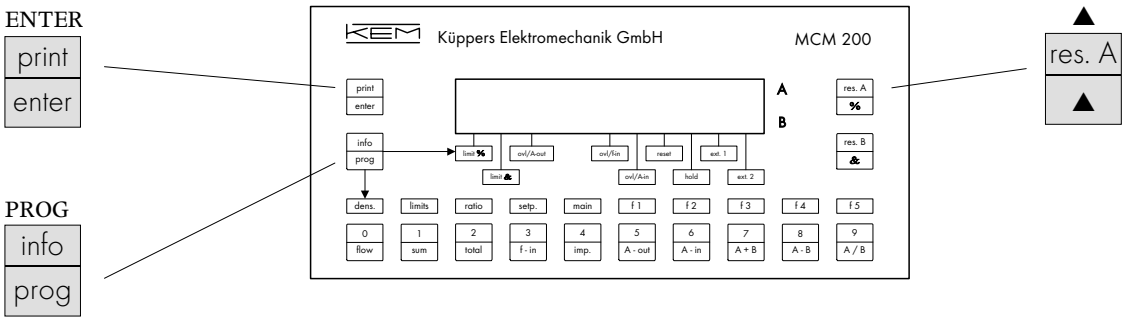
```
* K E M * -date of manufacture-
Elektromechanik GmbH
```

The above message is followed by the setup

General notes on programming

The following explanations and instructions consider all features (incl. options) and possible adjustments. In accordance with your personal MCM-version and adjustments it may occur that some of the following displayings do not appear. This is because the MCM 200 will skip options which are not included in your version, e. g. the MCM will not ask you for the ratio adjustments, if your MCM is a one channel version. Moreover, in accordance with your adjustments, the MCM 200 skip those setup and process parameters which are not required, e. g. the MCM will leave out the density parameter, if you select a volumetric unit for the flow rate.

Keys required for the setup programming



Setup

The setup determines the operation mode of the MCM 200 as a monitoring unit or a controller unit with monitoring capabilities (The controller functions are of course only available, if the corresponding options are included).
The setup includes basic adjustments which are usually done with start up only. The setup adjustments will influence the process parameters. This is why the setup is separated from the programming of process parameters.

Start the setup as described on page 20 and wait until the following appears in the display:

```
Setup - MCM 200 -___
__Channel  : A_____
```

The setup is divided into 4 sections. Press ▲ to go through the sections. Press PROG to start programming.

```
Setup - MCM 200 -___   A          Setup - MCM 200 -___   A
__Channel  : A_____   B          __Channel  : B_____   B

Setup - MCM 200 -___   A          Setup - MCM 200 -___   A
_Limits 1 - 6______   B          _____Master_________   B

Setup - MCM 200 -___   A          Setup - MCM 200 -___   A
__Centronics : _____   B          __Parameterprint____   B
```

Afterwards several sections will appear in the display. To confirm or skip a section press ENTER.

Setup Channel A and B

This setup section will determine the operation mode of the channels as measuring or controller.
You may select different modes for both channel A and B.

Operation Mode

Five modes are available. Press ▲ to go through the modes. When the desired mode appears press ENTER and proceed with the next parameter.

```
Operation Mode ?_____    A      Section title
Measuring Mode_______    B      possible mode
```

For measuring mode with measurement of frequencies, analogue in- and outputs and to operate the limits. Two-channel versions do additionally allow for ratio processing.

```
Operation Mode ?_____
PI-Setpoint Fix______
```

For controller mode with a fixed setpoint. The setpoint is entered when programming the paramters.

```
Operation Mode ?_____
PI-Setpoint Analog._
```

For controller mode with varying setpoint. The setpoint is determined by the analogue input.

```
Operation Mode ?___
PI-Setp.Ratio Fix___
```
(appears during setup of channel B)

Channel B may be used as a ratio controller. The desired ratio is entered when programming the parameters. and will be available as an anolgue signal by the analogue output of channel B.

```
Operation Mode ?___
PI-Setp.Ratio Analog
```
(appears during setup of channel B)

As above, however the ratio setpoint may be determined by the analogue input.

Flow Unit

```
Flow Dimension_______    A
______l/min___________   B
```

Press ▲ to go through the selection. When the desired unit appears, press ENTER and proceed with the next parameter.

Decimal Point Flow Rate

You may determine the accuracy of the flow display by the decimal point position.

```
Dez.Point Flowrate:
_____0000.0 l/min___
```

Press ▲ to move the decimal point. Please note, the decimal places are limited for some units.
Press ENTER when the decimal point has reached the desired position.

Offset Analogue Input

The analogue input has a range of 0 or 4–20 mA and 0 or 2–10 V. Offset will shift the minimum level from 0 to 4 mA and 2 V respectively. The adjustment depends on the sensor range connected with the analogue input.

```
Analog-In Offset  ?_          Analog-In Offset  ?_
_______No_____________       _______Yes____________
```

Press ▲ to select and »ENTER« to save.

Response Analogue Input

The analogue input is equipped with an integrating sigma-delta-converter which has a measuring rate of 3 measurements per second. Fluctuating measuring signals, e. g. caused by pressure peaks can adversely affect the evaluation. To compensate these adverse effects you may change the response time of the analogue input from »fast (= 3 measurements per second)« to »slow (smooth mean value method)«.

```
Time Analog Input :_          Time Analog Input :_
______Fast____________       ______Slow____________
```

Press ▲ to select and ENTER to save and proceed.

Unit Analogue Input

Do now select the suitable unit for the analogue input signal from the pre-selections.

```
Analog-In Dimension_
_______bar_____________
```
e. g. bar, if analogue signal represents pressure

Press ▲ to go through the pre-selections. Press ENTER to save when the suitable unit appears.

Decimal Point Analogue Input

You may determine the no. of decimal places for the displayed analogue input signal here.

```
DP-Analog-Input_____          DP-Analog-Input_____    A
_____0000.0 bar_____          _____000.00 bar_____    B
```

Press ▲ to move the decimal point. Please note, the decimal places are limited for some units.
Press ENTER when the decimal point has reached the desired position.

Offset Analogue Output

The analogue output is capable of providing 0/4–20 mA or 0/2–10 V. Offset will shift the minimum level from 0 to 4 mA and 2 V respectively (independent of whether the analogue output is used as a setpoint output for the PI-controller or as a flow-proportional output signal).

```
Analog-Out Offset ?_          Analog-Out Offset ?_
_______No_____________        _______Yes____________
```

Press ▲ to move the decimal point. Press ENTER to save and proceed.

Response Analogue Output

If you intend to use the analogue output as a flow-proportional current or voltage output (only possible in the measuring mode), you may now select between a fast and a slow response time.

- Selecting »fast« means the analogue output signal will be available after a measuring time of approx. 150 ms. The exact measuring time depends on the pulse width of the input frequency (edge-controlled pulse width measurement).
- Selecting »slow« means the measurement will be based on a smooth mean value method to compensate interference, e. g. caused by piston pumps.

```
Reaction-Time :____           Reaction-Time :____
______Fast____________        ______Slow____________
```

Press ▲ to select and ENTER to save and proceed.

Linearisation

You may activate a 10-point linearisation of the frequency measurement for each measuring channel.

```
Linearisation  ON ?_          Linearisation  ON ?_    A
_________No___________        _________Yes_________    B
```

Press ▲ to select and ENTER to save and proceed.

Sum Counter Reset via Key

In addition to the reset of the sum counter (cf. p.) via external contact, your adjustment for this setup parameter will faciliate or prevent a reset of the sum counter of each channel via the MCM keyboard, e. g. for operators on site.

```
Key= Batch-Reset ?__          Key= Batch-Reset ?__
______No______________        _______Yes____________
```

Press ▲ to select and ENTER to save and proceed.

PI-Controller Type

The PI-controller is used to drive final control elements like valves. A set point/actual comparison will detect deviations and trigger off a control operation where the controller output (analogue output) is changed to compensate the deviation. The MCM 200 will always wait until the valve correction time has passed to ensure that the control operation is carried out completely. The involved calculations depend on the adjustments for factor I and P (programming of process parameters).

Two different PI-controller types are available:
- Controller type 1 considers the valve correction time as a constant parameter irrespective of the alteration.
- Type 2 considers the die valve correction time in proportion to the alteration.

Example for controller type 1:
Electro-pneumatically controlled valve, time constant = 250 ms
The controller changes the control output in accordance with the alteration and waits 250 ms to perform the next setpoint/actual comparision.

Example for controller type 2:
Valve with *electromechanical rotary drive*, valve correction time for 0–100 % = 15 seconds
A setpoint change of 15 % will require 15 % of the valve correction time, i. e. 2.25 seconds. The controller changes the control output and waits 2.25 seconds to perform the next setpoint/actual comparision.

```
PI-Contr- Typ   ?___          PI-Contr. Typ   ?___
_____Type 1_____________      ______Type 2_____________
```

Press ▲ to select the controller type- and ENTER to save and proceed.

Controller Output Behaviour with activated HOLD

With activated HOLD, e. g. after completion of a spraying cylcle, the state of the controller output will be maintained, i. e. the actual signal of the analogue output is saved and the control functions are interrupted. In accordance with your system you may now determine whether the controller output to is set to zero or the last control signal is maintained after activating HOLD.

HOLD-OUT = Hold
The current output signal and valve state is maintained. After disabling HOLD the controller immediately starts off operating with the maintained value.

HOLD-OUT = Zero
When HOLD is activated the current output signal will be saved. Afterwards the controller output is set to zero which will close the valve. When HOLD is disabled the controller starts off with the saved output signal after the the valve correction time has passed.

```
Contr.Out at Hold ?           Contr.Out at Hold ?
_______Zero!___________       ______Hold_____________
```

Press ▲ to select and ENTER to save and proceed.

Ratio Calculation

Equipped with two channels, the MCM can calculate and evaluate the ratio of the real time values of both channels. The ratio is calculated A : B. In accordance with your application and system you may select from 3 methods to calculate the ratio. For all methods a sufficient number of pulses should be considered for the ratio calculation to achieve a satisfying accuracy. With low input frequencies and/or short process periods (e. g. low flow rate with a small K-factor and short batch process) the number of pulses of the ratio channel B may be very small and require a summarization of several sub-processes or a different method for the ratio calculation. Please note the response time of the measuring system is affected by the adjustments for the ratio calculation.

Press ▲ to select and press ENTER to save.

According to pulse preset

```
Ratio-Calculations ?
by pulses ___________
```

The unscaled pulse preset is entered when programming the process parameters. The MCM will calculate the ratio A : B as soon as the preset has been reached. Both channel must exceed the pulse preset to avoid the channel with a lower pulse count will affect the accuracy. Accuracy will improve with increasing presets.

By external contact

```
Ratio-Calculations ?
external Switch  ___
```

The ratio is calculated after disabling the external contact 1 of the rear terminal, e. g. at the end of a batching process. If the MCM is used as controller, the process period should be longer than the time required to control a setpoint/actual comparison.

By real-time value

```
Ratio-Calculations ?
at Flow-Value________
```

The ratio of the real-time values is calculated in accordance with the gate time setting (programming of process parameters) and the pulse width of the input frequency.

Setup Limits 1-6

The MCM 200 has 6 switch outputs which you may relate to process parameters by your own choice.
You may use the limits to control 6 different parameters or relate up to 6 limits to a certain parameter (e. g. when pre-alarms are required).
For each limit which is related to a real-time or analogue value a maximum, minimum and hysteresis is programmable. Limits which are related to the sum counter include only a maximum. Any exceeding or bypassing of the limits will activate the corresponding limit switch output which may be used to trigger off an acoustic or visual signal

```
Setup - MCM 200 -
   Limits 1-6
```

Press PROG to start programming. The first limit mode appears in the display (see below).
Press ▲ to go through the limit modes and press ENTER to save when the desired mode appears in the display.
The real values for the limits will be entered when programming the process parameters.

FLOW-LIMIT A

```
Operation-Mode: LIM ...
Flow-Limit A________
```

To control the real-time value (e. g. actual flow rate) of channel A for max- and minimum.

FLOW-LIMIT B
As above for channel B.

FLOW-LIMIT A+B
As above for the sum of the real-time values of channel A and B.

SUM-LIMIT A :

```
Operation Mode: LIM ...
Sum  Limit A______
```

To control the scaled sum counter of channel A for maximum count. When the maximum count is reached the switch output will be active. A reset of the sum counter by external contact will disable the switch output.

SUM-LIMIT B :
As above for the sum counter of channel B.

SUM-LIMIT A+B :
As above for the sum of both channel counts.

RATIO-LIMIT A/B

```
Operation Mode: LIM ...
Ratio-Limit A/B_____
```

Percentual limit for the ratio of channel A and B controlling the max. deviation (requires identical units of both channels).

ANALOG-IN LIMIT A

```
Operation Mode: LIM ...
Analog-In Limit A___
```

To control the scaled analogue input signal of channel A.

ANALOG-IN LIMIT B
As above for channel B.

PI-CONTROLLER A: SET/ACT LIMIT

```
Operation Mode: LIM ...
PI-Contr.A: Set/Act
```

To control the difference between setpoint and actual value in the controller mode of channel A.

PI-CONTROLLER B: SET/ACT LIMIT
As above for channel B.

Setup MASTER

In this section you may determine the access to some certain parameters via hot keys, i. e. later on these parameters can be re-programmed during operation without having to go through the complete programming process. As precondition the control input »quick programming« has to be connectied.
After static contact of control input 3 and pressing of the related hot keys DENS, LIMIT, RATIO, <MAIN> or <SETP.>, the MCM 200 will ask you for the new value for the parameter.
You of course also prevent the parameters from being changeable in the a. m. way.

Enable quick programming for DENSITY?

This parameter will only appear with mass-related units like kg per minute.

Quickprog.Density? **Quickprog.Density?**
_____No_____ **_____Yes_____**

Press ▲ to select and ENTER to save and proceed.

Enable quick programming for LIMITS?

Quickprog. Limits? **Quickprog. Limits?**
_____No_____ **_____Yes_____**

Press ▲ to select and ENTER to save and proceed.

Please note
During the quick programming the measuring mode is inter-rupted and the outputs take the following status: limits L1-L6: neutral, analogue output: 0–20 mA and 0-10 V).

Enable quick programming for SETPOINT?

Quickprog. Setpoint? **Quickprog. Setpoint?**
_____No_____ **_____Yes_____**

Press ▲ to select and ENTER to save and proceed.

Enable quick programming for RATIO?

Quickprog. Ratio ? **Quickprog. Ratio ?**
_____No_____ **_____Yes_____**

Press ▲ to select and ENTER to save and proceed.

Enable quick programming for K-FACTOR?

Quickprog. K-Factor **Quickprog. K-Factor**
_____No_____ **_____Yes_____**

Press ▲ to select and ENTER to save and proceed.

Setup RS232/RS485-Transmission Parameters

The MCM 200 may optionally be equipped with a serial communication interface to read and/or write parameters and operation values. Two types of interface are available: RS 232 or RS 485 (use only one at a time). Two parameters are required for a correct data transmission. Start programming pressing the PROG key when »SETUP RS232/485« appears.

Baudrate
Select the speed of transmission using the ▲ key. 2400, 4800 and 9600 Bd are available.

```
____Baudrate : _____   A     ▲     ____Baudrate : _____   A
_______2400___________   B     ...   _______9600 _______   B
```

The remaining transmission parameters are as follows:

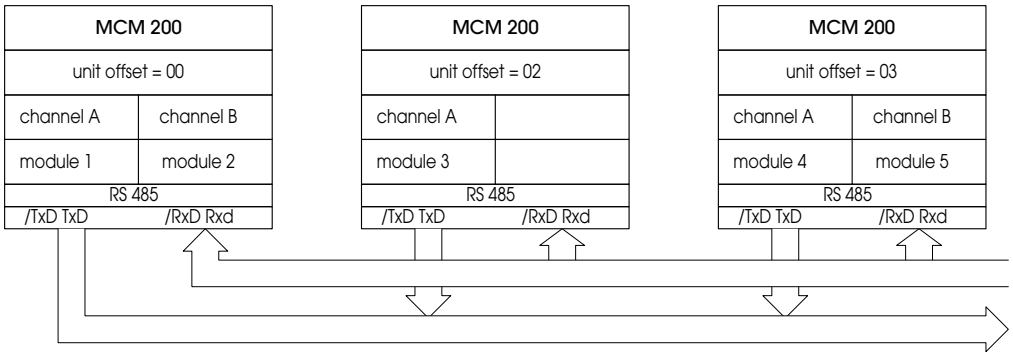
Dataformat: 8 Bit , Startbit: 1 , Stopbit: 1, Parity: none
Confirm pressing ENTER and proceed with the next parameter.

Unit-Offset

Up to ten MCM 200 units may be operated together in an RS485-network. Thanks to the tri-state-output of the send components several MCM 200-interfaces have access to one send channel. However a module offset has to be specified for each MCM in order to avoid that two units will send data simultaneously.

Internal module numbers of the MCM 200 :
channel A ➔ module number 01/channel B ➔ modulenumber 02

Module offset = number of channels ahead



Enter the module offset in the following mask:

```
___Unit-Offset :____   A
________003_________   B
```

Enter the figure (0...255) via the numerical keys [0]...[9] and confirm pressing ENTER. The programming of the RS 232/485 is now completed.

1.5 Setup Time/Date

The serial/parallel interface of the MCM 200 has a batteriy-buffered crystal clock and a calendar to include time and date in printouts (e. g. production or batch reports). The defaults correspond to the actual time and date, however, they may be altered in the setup by pressing PROG when »time/date« appears in the display.

1.5.1 Setup Time

First you are required to enter the time. The display shows the current time adjustment:

```
___Set_Time : _______    A
_______hh:mm__________   B
```

Enter the desired time via the numerical keys [0] to [9].
Example: if the desired time is 21:45 (= 9:45 p.m.) press 2 1 4 5 and save with ENTER

The MCM will now check your adjustment (hours: 0 to 23 and minutes 0 to 59). False adjustments will prevent the MCM from proceeding with the next parameter and you may enter the time again. After correct time adjustment the MCM proceeds to the date programming.

1.5.2.1 Setup Date

The display shows the current date adjustment (day followed by month):

```
_______Set Date : ___    A
________dd:mm_________   B
```

Enter the desired dated via the numerical keys [0] to [9].
Example: if the desired date is 18. May enter press 1 8 0 5 and save with ENTER.

Again the MCM will check your adjustments (day: 1 to 31, month: 1 to 12). False adjustments will prevent the MCM from proceeding with the next parameter and you may enter the time again. After correct time adjustment the MCM proceeds to the year programming.

1.5.3 Setup Year

The display shows the current year adjustment:

```
_______Set Year : ___    A
________1998__________   B
```

You may increase the value via the ▲ key (from 1998 up to 2020). When the desired value appears press ENTER to save. Afterwards the MCM will return to the setup channel A display. The programming of the clock and calendar is now completed. The programmed values will apply as soon as you leave the setup.

1.6 Setup Centronics

Die optional printer interface corresponds to the centronics standard. A customary printer cable (PC: 25 pin Dsub plug -> printer (36 pin centronics plug) may be connected to the 25-pin Dsub socket.
No hardware adjustments are necessary, this section includes the programming of parameters relevant for the printout itself. Press PROG to start programming.

1.6.1 Unit-Number

You may enter an individual number ranging from 0 up to 255 for each MCM 200. This number will appear on each printout of parameters and measuring value.

```
_____Unit Number :__    A
___________000_______   B
```

Enter the value via the keys [0] to [9]. After saving with ENTER the next parameter will appear.

1.6.2 Printout-Number

Each print request will be registered and serially numbered by the MCM 200. The number appears on all printoutouts to ease differentiation and allocation. This parameter determines the start off value from which the MCM will count on up to 65535 before the counter is reset to 0.

```
__Printout-Number:__    A
_________00000_______   B
```

Enter the desired start off value via the keys [0] to [9]. After saving with ENTER the next parameter appears.

1.6.3 Unit Identification

You may enter a 20-character-chain of your choice (e. g. »production line A«) for each MCM which will appear on a fixed position of your printouts.

```
__Unit-Ident : _____    A
_XXXXXXXXXXXXXXXXXXX    B
```

The flashing cursor is located on the lefthand side. Pressing the ▲ and ▼ keys will scroll the characters

```
[Space]!"#$%&'()*+-./0123456789:;<=>?@ABCDE..XYZ[\]^_
      -----⇧-----------------------------------------
       ▼      ▲
```

When the desired character appears press PROG to move the cursor in righthand direction. When the last digit is reached, the next pressing of PROG will move the cursor back to its original lefthand position.

After completion of your adjustment press ENTER to save and proceed with the next parameter.

1.6.4 Print-Format

The MCM 200 is capable of printing out individual user reports. The report may contain up to 10 measuring values printed on individual lines with a programmable printing order.

```
__Print on line: 0__    A      PROG          _Print on line: 9_      A
___Flow-Value_______    B      ....          __Flow-Value_______     B
```

Start to select the measuring value to be printed in the first line of the report. You may scroll the selection as per the table below pressing the keys ▲ and ▼. When the desired value appears press PROG to proceed with the selection of the value for the next line. The programming of the report is completed when »no print« is selected. Save your adjustments by pressing ENTER.

Measuring values for printouts

Description	Layout
Flow-Value	Real time value channel A [dimension] real time value channel B [dimension]
Flow-Value A+B	sum of real time values of channel A and B [dimension]
Flow-Value A-B	difference of real time values channel A and B [dimension]
Flow-Value A/B	ratio of real time values of channel A and B [no dimension]
Batch Value	sum channel A [dimension] sum channel B [dimension]
Batch Value A+B	addition of sums channel A and B [dimension]
Batch Value A-B	difference of sums channel A and B [dimension]
Batch Value A/B	ratio of sums channel A and B [no dimension]
Total Value	total count channel A [dimension] total count channel B [dimension]
Analog Input	scaled analogue value ch. A [dimension] scaled analogue value ch. B [dimension]
Ratio	ratio calculated according to »Ratio-Calculations« (cf. 1.1.14)
--no print--	end of individual report

Please note the default print fomat includes only the flow value printed on the first line. Printouts may be triggered by pressing PRINT followed by INFO or via the external control input.

1.7 Parameter-Print

In the setup mode all MCM parameters may be printed out. Select the following option in the setup mode:

```
__Setup : ___________    A
__Parameterprint_____    B
```

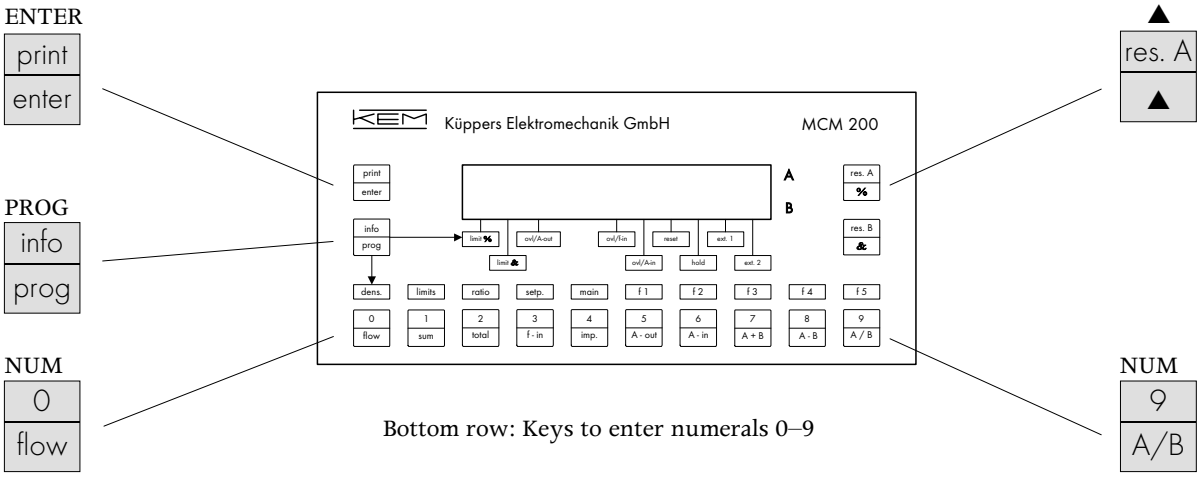
Pressing PRINT will trigger a printout of a complete list of parameters. Please note, this function is only available in the setup mode.

2.0 Programming of Process Parameters

The setup adjustments determine the operation mode of the MCM 200. In accordance with these adjustments you are now required to enter certain process parameters like K-factor of the flow meter, limits, setpoints etc. The programming of each channel can be divided into max. 6 levels (depending on hard- and software options as well as your previous setup adjustments).
Each level includes parameters related to a certain function (display scaling, linearisation, controller etc.).
The limits are entered independently of the measuring channel as their relation was determined in the setup.

Do not panic, if some of the parameters explained on the following pages do not appear.
The MCM 200 will only ask you for those parameters which are required by your setup adjustments.
Examples: If your MCM 200 has no analogue input, the related parameters will be skipped.
If you selected controller as operation mode in the setup the MCM will now skip the scaling of the analogue output it is used as a controller output.

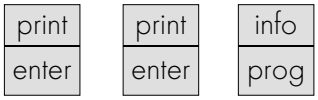
Keys required for the programming of process parameters



Bottom row: Keys to enter numerals 0–9

Please note for entering numerals
Entering numerals will erase the predecessor. The numerals enter the display on the right handside and are moved to the left handside by the following numerals. If your adjustment is outside the allowable range, the original adjustment will re-appear after pressing ENTER and the MCM asks you to enter the parameter again (blinking cursor). To proceed, your adjustment must be in the allowable range.

To start the programming of the process parameters press the following keys:



Afterwards the following is shown in the display:

```
Programming __?_____
__Channel : A _______
```

(If you want to return to the measuring mode press ENTER)

Press ▲ to select between the following:

```
Programming    ?_____    Programming    ?_____    Programming    ?_____
__Channel : A _______    __Channel : B _______    Limits 1 - 6 ________
```

Press PROG to confirm your selection. The display shows the first programming level and parameter respectvely. Please note, the second line advises how to proceed:

Second display line: ^=NEXT P=PROG E=QUIT which means

press ▲ (shown as ^ in the display) for the next parameter level
press PROG to start programming the current level
press ENTER to quit programming and start the measuring mode

Programming Channel A and B

Level: K-factor and Gate Time

The display shows the following:

```
K-Fac./Gate-Time_____
^=Next P=Prog E=QUIT
```

Press PROG to enter the K-factor of the flow meter according to the KEM calibration record and the gate time afterwards.

K-FACTOR (Imp/l)

The adjustment affects only the frequency input. The calibration record shows the average K-factor in pulses per litre. When entering the K-factor please note, max. 2 decimal places are possible.
The display shows the last-entered K-factor, e. g.:

```
K-Factor :___________
_____1000.00 Imp./l__
```

Enter the K-factor according to the calibration record using the NUM keys 0–9 (bottom row). Press ENTER save and proceed.

GATE TIME (msec)

This parameter determines the response time of your measuring system and enables you to adapt the measuring time of the respective channel to your requirements.
Example: periodic disturbances caused by piston pumps will be included in the displayed value, if the gate time is too short. Choosing an appropriate gate time, the disturbances can be calmed or even eliminated.

```
Gate-Time : _________
______104 ms _________
```

Pressing ▲ will add 104 ms to the current value. The values range from 104–3224 msec.
Press ENTER when the desired value appears in the display. The MCM returns to the »K-Fak./Gate-Time« display. Press ▲ to proceed with the next parameter.

Level: Density (only with mass-related units)

KEM flow meters are volumetric meters. If you wish to display or evaluate a mass flow, you may convert the volume flow into a mass flow by the density of the measuring medium.

```
Density :_____________
^=Next P=Prog E=Quit
```

Press PROG to enter the density.

Parameter DENSITY (kg/m³):

Now enter the specific gravity of the measuring medium via the NUM keys.

```
Density :_____________
_____1000 kg/m3 _____
```

Press ENTER to save. Afterwards the MCM goes back to the »K-Fac./Gate-Time« display. Press ▲ repeatedly until the level »analog-out adjust« appears.

Level: ANALOG-OUT ADJUST

If the analogue output is used to provide a flow proportional signal (0/4..20mA and 0/2..10V), you may now adjust the entire analogue range to represent a flow range by your choice.
You do not have to consider the frequency for programming this parameter as the relation between frequency and flow rate is already known by the parameter K-factor.
Analogue offset, Flow unit and decimal point depend on your setup adjustments.

```
Analog-Out Adjust___
^=Next P=Prog E=Quit
```

Press PROG to scale the analogue output.

Parameter ANALOG-OUT START (Flow unit)

Now enter the flow rate which is supposed to be represented by 0/4 mA or 0/10 V.

```
Analog Out Start ___
_____0000.00 l/min___
```

Enter the flow rate using the NUM keys, afterwards press ENTER to proceed.

Parameter ANALOG OUT END (Flow unit)

Now enter the flow rate for 20 mA or 10 V. It must be greater than the start value. Otherwise the following message will appear in the display: »**A-GAIN < A-START**“, „**PRESS ENTER TO CLEAR**«. Press enter and re-enter the value.

```
Analog Out End  _____
_____0000.00 l/min___
```

Enter the flow rate using the NUM keys and save with ENTER. Afterwards the MCM goes back to the »K-Fac./Gate-Time« display. Press ▲ repeatedly until the level »analog-in adjust« appears.“.

Level: ANALOG-IN ADJUST.

Each channel can be equipped with an analogue input which may be used as a setpoint output for the PI controller or as an additional input for measuring values which are available as an analogue signal (e. g. pressure or temperature). The mode was determined in the setup programming.

```
Analog-In ADJUST____
^=Next P=Prog E=Quit
```

Press PROG to programme this parameter.

Parameter ANALOG-IN ADJUST

For a few seconds a message in the second line will inform you on the current analogue offset status.

```
Analog-In Offset ?__
__________Off_________
```

Afterwards you are requested to adjust the analogue input. The MCM will take the unit and decimal point settings of the setup programming.

```
Analog-In Adjust  :_
___0000.0 l/min_____
```

Enter the value corresponding to 20mA or 10V using the NUM keys.
Press ENTER to save and return to the »K-Fak./Gate-Time« display.

Level: LINEARISATION PROG

A 10-point-linearisation is available the frequency input of each channel. The linearisation will eliminate the linearity error of the flow meter leaving only the repeatability error which is usually ±0.1%.
Take a look at the calibration record of the flow meter, you will find a table listing the following:

Frequency (Hz)	K-factor (pulses per litre)	Flow (l/min)	Flow (l/h)	Error (% of actual flow)
6,66	17050,41	0.023	1.38	-0,305
14,95	17066,94	0,053	3.18	-0,209
28,81	17068,49	0,101	6.06	-0,200
139,08	17014,29	0,490	29.4	-0,517

You may now enter up to 10 frequencies with the corresponding error (at least 2 are required). If more than 10 frequencies are listed in the record chose 10 characteristic ones.

The first display looks as follows:

```
Linearisation Prog._
^=Next P=Prog E=Quit
```

Press PROG to start programming

Parameter LIN.POINT 1

Enter the first frequency. Decimals as in the calibration record cannot be entered, rounded figures are sufficient.

```
Lin.Point : 1 _______
_______00000 Hz ______
```

Press ENTER-to proceed with the corresponding error.

Parameter ERROR POINT 1

Now enter the error of actual flow as per calibration record. The max. input is ±12.7 %.
Press ▲ to select the sign.

```
Error Point  : 1____
____+ 00.0 % ________
```

Press ENTER to save and proceed with the next frequencies and errors accordingly.
If less than 10 points are to be entered you may stop programming by entering a frequency of 00000 Hz and an error of 00.0 %.
After saving the last entry the MCM returns to the »K-Fak./Gate-Time« display.

Level: PI-PARAMETERS

The PI-controller enables for rapid flow control. Control operations are based on a setpoint/actual comparison. Thanks to its adaptive abilities the MCM will save all control operations. As soon as a known alteration re-appears the controller will immediately change the setpoint using the saved value instead of a evaluating a new setpoint/actual comparison thus saving time.
To adapt the controller to your system you are now required to enter the controller parameters which affect the performance of the controller.

```
PI-Parameter :   ___
^=Next P=Prog E=Quit
```

Press PROG to proceed.

Parameter P-FACTOR

This is a proportional factor which will strengthen the effect of a control operation calculated by the setpoint/actual comparision on the setpoint output.
High values for the P factor will accelerate the controller at increasing setpoint/actual deviations.
However, in accordance with your control task this may lead to oscillation.
It is recommended to determine the ideal value carry by trials as corresponding calculations are complicated.
Start off with a P-factor of 10 and observe the reaction of your system. In accordance with the reaction try smaller or higher values until a reasonable adaption to your system requirements is found.

```
P-Factor : __________
_____00_____________
```

Use the NUM keys to enter a value between 1 and 50. Press ENTER to save and proceed.

Parameter I-Factor

This integral action controller minimizes the difference between setpoint and actual value calculated in accordance with the a. m. P-factor setting.
As above you are required to find a compromise between velocity and accuracy. Begin with an I-factor of 5 and observe the reaction of your system to deviations. Afterwards adapt the value for the I-factor step by step until results are satisfactory.

```
I-Factor : __________
_____00_____________
```

Use the NUM keys to enter a value between 1 and 50. Press ENTER to save and proceed.

Parameter CONTROLLER-DEVIATION

This parameter determines the accuracy of the control operation by determining the an allowable percentual deviation of the actual value from the setpoint.
As long as the calculated deviation exceeds the allowable deviation, the controller will go on improving the setpoint output until the deviation is in the allowable range. As soon as this is the case the MCM will save the current value of the setpoint output and use it when the same deviation appears again. Up to 2,000 setpoint values can be saved (cf. »adaptive abilities«, 1st paragraph).

```
Contr.-Deviation  __
______0.0 %_________
```

Values can be entered in steps of 0.1 and range from ±0.1% to ±12.7%.
Use the NUM keys to enter and press ENTER to save and proceed.

Parameter VALVE CORR.-TIME

Each final control element requires a certain time to carry out a control operation.
This time has to be entered now to ensure the control operation is carried out completely before a new setpoint/actual comparison is effected.

The correction time to be entered depends on the type of valve and the corresponding PI-controller type.

- Electro-pneumatically controlled valves (PI-controller type 1):
  constant correction time irrespective of the alteration.

- Valves with electromechanical rotary drive: (PI-controller type 2):
  The correction time is a (linear) function of the alteration. Enter the correction time for 100%, the MCM will calculate the required correction time in accordance with the alteration.

```
Valve Corr.-Time  __
___00100 ms _________
```

The valve correction time may range from 100ms to 20,000 ms. Enter the value via the NUM keys and press ENTER to save and proceed.

Please note:
The EPROM saving the setpoint output may be reset in the quick programming.

Level: PI-SETPOINT

The type of setpoint (fix setpoint/analogue setpoint/fix setpoint ratio/analogue setpoint ratio) and the related unit (e. g. litres per minute or %) and resolution has been programmed in the SETUP.
In accordance with your setup adjustments for the setpoint, unit and resolution you may now enter the value for the setpoint.

```
PI-Setpoint : _______
^=Next P=Prog E=Quit
```

Press PROG to start the programming of the setpoint.

Parameter FIX-SETPOINT
Appears when fix setpoint was selected in the setup.

```
Fix-Setpoint : ______    A
___000.00 l/min _____    B
```

Enter the value via the NUM keys and press ENTER to save and return to the »K-Fac./Gate-Time« display.

Parameter RATIO SETPOINT

Appears if ratio setpoint was selected in the setup of channel B.
A 2-channel MCM 200 can calculate the ratio of the frequency inputs of channel A and B. Thus channel B may be used as a ratio controller by programming the setpoint as ratio to the real-time value of channel A. Enter the ratio channel A : channel B (A/B) which will be maintained by the controller.

```
Ratio Setpoint (A/B)
_____ 1.000 R _______
```

Enter the value via the NUM keys and Die Eingabegenauigkeit ist auf 0.1 %-Punkte begrenzt
Press ENTER to save and return to the »K-Fac./Gate-Time« display.

Level: RATIO

The MCM can calculate the ratio of channel A and B based on different parameter which may be selected in the setup. If the ratio calculation is programmed based on a pulse preset, you may now enter the value for it.

```
Ratio Programming___
^Next P=Prog E=Quit_
```

Press PROG to start programming.

```
Ratio Batch   ? _____
_____ 01000 Imp._____
```

Enter the value via the NUM keys and press ENTER to save and return to the »K-Fac./Gate-Time« display.

Level: Limits 1–6

In the setup the limits are related to certain parameters like flow rate or ratio. You may now enter the real values for the limits 1 to 6 and the corresponding hysteresis.
Press PROG to proceed. First you are required to enter the response time for the limits.

Limit Response Time

The response time applies for all limits. It prevents the limits from reacting too early, e. g. when starting up a system. The allowable adjustment ranges from 104ms to 5200ms and can be selected in steps of 104ms.
After activating the limits via their external contacts the limits are put in a neutral state until the response time has passed.

```
Limit Response Time : ?
_______104 ms_____________
```

Press ▲ to select a response time in upward steps of 104ms. When the desired value appears, press ENTER to save and proceed.

Flow Limit A/Flow Limit B/Flow Limit A+B/Flow Limit A–B

You may now enter the values for the limits 1–6 in numerical order. Three inputs are required for each limit, these are: Max limit, Min Limit and Hysterisis. Proceed with limit 1.

```
FlowLim ...Max._____L ...
_00100.00 l/min______
```

limit-controlled parameter (e. g. flow rate) and limit no value for limit max

Use the NUM keys to enter the limit press ENTER to save and proceed with the min value.

```
FlowLim..._Min._____L ...
_00010.00 l/min_____
```

Use the NUM keys to enter the limit press ENTER to save and proceed with the hysteresis.

```
Hysteresis:_________L ...
_______0.1 %_________
```

If the volume or mass flow is unstable (e. g. due to piston pumps), the limit switch output may start to »scatter« when the flow rate approaches the limit. To avoid this enter a hysteresis which is slightly higher than the percentual flow variation within the max. limit range.

Example: with flow variations of 3.5% in the upper range, the hysteresis should be approx. 3.8%.

Limit for Sum Counter A/Sum Counter B

Now enter the count of the sum counter (A or B) which is supposed to activate the related switch output. In accordance with the number of limits related to the sum counter, you may use the switch output of the programmed limits as pre-alarm and main alarm, e. g. to reduce the flow rate for the last 10 % of a batch process.

```
      Sum ...:_________L ...
_00323.45 Liter__________
```

Enter the value via the NUM keys and press ENTER to save and proceed.

Ratio A/B Limit

To control the ratio of channel A and B.

Example:

- The ratio of components A and B must be 2.000 (e. g. A = 100 l/min, B = 50 l/min).
  Enter 2.000 for ideal ratio A/B.
- The max. allowable deviation is 3.5 %.
  Enter 3.5 % for ratio deviation
- The flow rates oscillates by 0.8 %
  Enter a percentage which is slightly higher than 0.8 % for hysteresis to avoid scattering of the swicht output.

```
      Ideal Ratio A/B:__L ...
____2.000 / 1_______
```

Enter the value via the NUM keys and press ENTER to save and proceed with the max. percentual deviation.

```
      Ratio Deviation :_L*    A
_____03.5 % 1_______    B
```

Enter the value via the NUM keys and press ENTER to save and proceed with the hysteresis.

```
      Hysteresis  :_______L ...
______1.0 % _________
```

Analog In Limit A/Analog In Limit B

To control the analogue inputs for max- and minimum.

Example:
For safety-reasons the maximum pressure for pipe A is 14.5 bar.
The minimum pressure required to maintain operation. is 12.8 bar.
An exceeding or bypassing shall be signalized acoustically.

Enter 14.5 bar for analog-in max and 12.8 for analog-in min.

The pump creates pressure variations of approx. 1% of the nominal value.

Enter a value which is slightly higher than 1% for hysteresis to compensate the pressure variations.
If 1.5 % is entered for hysteresis, the switch output to drive an acoustic source will only be active when the limit are exceeded or bypassed by 1.5%. This way you will avoid a scattering of the switch output when the pressure approaches the limits.

```
Analog In-... Max.:_L ...
_000014.5 bar_______
```

Enter the max. limit via the NUM keys and press ENTER to save and proceed with the minimum.

```
      Analog In-? Min.:_L*    A
_000012.8 bar_______    B
```

Enter the min. limit via the NUM keys and press ENTER to save and proceed with the hysteresis

```
      Hysteris  :_______L ...
______1.5 %__________
```

Limit PI-Controller Setpoint/Act

This limit will control the difference between setpoint and actual value, i. e. the max allowable deviation of both values from each other independent of the programmed setpoint.
If the setpoint was constant, you could as well use this limit for a flow limit control. However, in this case you would have to re-programme the limit with each setpoint change.

```
      PI-Deviation ...:  L ...
_____04.5 % _________
```

Enter the allowable percentual deviation via the NUM keys and press ENTER to save and proceed with the hysteresis.

```
      Hysteris  :______L
______1.0 % _________
```

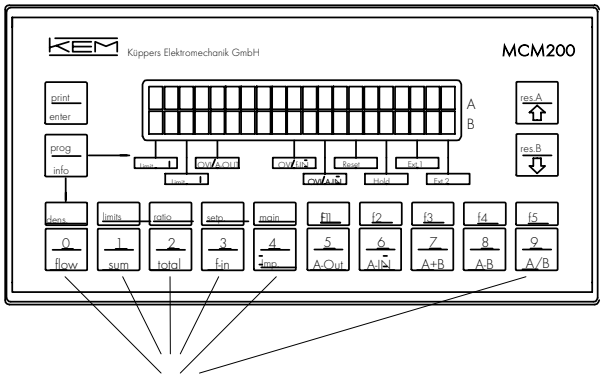
Enter the hysteresis via the NUM keys and press ENTER to save and proceed

2.3 Quick-Programming

The quick programming allows for re-programming of certain parameters in the measuring mode without having to go through the complete setup or process parameter programming.
As a precondition control input 3 must be connected and the quick programming for the parameters must be enabled in the setup MASTER. A key-operated switch may prevent unauthorized quick-programming.

Please note:
During the quick programming the limit outputs are neutral, the analogue outputs are set to zero and the measuring mode is interrupted.

Start the quick programming



- Make sure the MCM is in the measuring mode.
- Activate control input 3 and press the above keys to start quick programming of the parameters indicated above the keys.

The quick programming can be enable for up to five parameters in the setup MASTER). A comprehensive information on programming and parameters refer to the chapters »setup« and »programming process parameters«. In addition you may clear the EEPROM (see page 43)

Dens.: Density (only with mass-related units, e. g. kg/min)

Having started the quick programming of the density, the following message appears in the display for a few seconds.

```
Prog. Channel A
____________________
```

You may now enter the density for channel A.

```
Density:_____________
___1000 kg/m3________
```

Enter the density via the NUM keys (bottom row) and press ENTER to proceed with channel B accordingly. If channel B does not exist, the MCM will return to the measuring mode.

Limits

Start off with the response time for the limits. Press ENTER to skip, if the response time remains unchanged.

```
Limit-Response:
_______1664 ms________
```

Press ▲ to select a response time in upward steps of 104 ms. Press ENTER to save and/or proceed with the limits 1–6.

Ratio: Pulse preset for ratio calculation

You may now change the number of pulses which are considered for the ratio calculation.

```
Ratio Sum  ? ______      A
______ 01000 Imp._____   B
```

Use the NUM keys to enter the preset. Press ENTER to save and return to the measuring mode.

Setp.: Setpoint PI-controller

Having started the quick programming of the setpoint, the following message appears in the display for a few seconds to inform you on the channel which is to be programmed now.

```
Prog. Channel A______
_____________________
```

Proceed programming the setpoint (cf. page...)
Finally press ENTER to save and to proceed with channel B (as far as existing) or to return to the measuring mode.

Main: K-factor of the flow meter

Having started the quick programming of K-factor, the following message appears in the display for a few seconds to inform you on the channel which is to be programmed now.

```
Prog. Channel A______
_____________________
```

Proceed entering the new K-factor (e. g. after recalibration, service or when a new flow meter is used).

```
      K-Factor :___________    A
___1000.00 Imp./l___    B
```

Use the NUM keys to enter the K-factor. Press ENTER to save and to proceed with channel B or to return to the measuring mode.

Clear EEPROM

After a completed control operation, the EEPROM saves the value of the controller output.
If a new control operation is necessary, the MCM will search for suitable value in the EEPROM which will immediately be passed on to the controller output.
If no suitable value is found, the PI-controller will carry out a new control operation in accordance with the P and I-factor settings. On completion of the new control operation the MCM 200 will once again save the values. This is how the MCM adapts to a control process and its characteristic variations.

With new control processes (new working range, new control valve) it may be necessary to erase the EEPROM as otherwise the MCM would use the saved values of the last control process before a new control operation is carried out. You may avoid this by erasing the old values.

Activate control input 3 »Prog. Lock« and press the key below f 5 (bottom row).
The following appears in the display

```
* EEPROM  -CLEAR-___
__Channel : A _______
```

Press ▲ to select the channel. Press ENTER if you wish to stop and return to the measuring mode.
Press PROG to confirm the channel and the next message appears in the display.

```
__ready to clear ?__
__Prog=Yes Enter=No_
```

This is the last opportunity of stopping the EEPROM clearance.
Press ENTER to stop and return to the measuring mode.
To erase the EEPROM press PROG. The display will indicate the on going clearance as follows:

```
__Clear EEPROM : ___
___....          ___
```

On completed clearance, you may repeat the above procedure for the second channel.

```
* EEPROM  -CLEAR-___
__Channel : A _______
```

Press ▲ to select the second channel and proceed as described above or press ENTER to return to the measuring mode.

3.0 Interface

As an optional feature the MCM 200 may be equipped with a serial/parallel interface connecting the MCM 200 and its »surrounding«.
The serial communication interface can either be operated as type RS232 or RS422 and RS485 respectively enabling for a bi-directional data exchange with host systems like personal computers or a PLC.
The parallel printer interface, type centronics, allows for line printouts of measuring values and operation parameters.

Serial Communication

The communication interface alows for programming and/or reading of operation parameters and values of the MCM 200 (measuring values, status etc). The transmission log follows the OPTOMUX log by the OPTO22 company and is based on a transmission orientated to ASCII characters. The MCM 200 works as a »SLAVE« sending data on request only. Up to 15 MCM units may be operated in a bus structure by specifying individual device numbers for each MCM.

Parallel Printer Interface

The parallel interface may be used for printouts of measuring values and parameters with a centronics printer. While parameters will always be printed out completely, the measuring values to be printed may be selected via the MCM200. All printouts state date and time, they are started via the MCM's touch keyboard or one of the control inputs.

Serial Transmission Log

The external request has to stick to a certain syntax, to be accepted by the MCM. As mentioned above, the syntax follows the OPTOMUX log, only ASCII characters are sent and received. Details on the syntax will follow later on.

Read Request String

The request string contains the following:

<START CHARACTER> <CHANNEL NO.> <COMMAND> <SECTION> <ADDRESS> <CHECKSUM> <CR>

- start character: .....always start off with ASCII character '>'
- channel no.: .....a *2 digit hexadecimal number* specifying the measuring channel to communicate with. The HEX number is shown in ASCII characters (channel 5 ➔ '05')
- command: .....'K' for read request
- section: .....two sections are available: parameter and measuring value section ASCII character 'P' selects parameters and 'M' selects measuring values
- address:.....a *2 digit hexadecimal number* specifying the parameter or measuring value number to contact. The HEX number is shown in ASCII characters.
- checksum:.....a *2 digit hexadecimal number* reflecting the sum of all preceding characters, except for the start character. The sum is calculated by adding all hex values. The low-byte of the results (also use 2 ASCII characters to indicate a HEX number) is the checksum
- CR:.....each request string has to be completed with the Carriage Return-character (hexvalue 0D) as the MCM 200 will only start a log check on receipt of this character.

  Please note: HEX numbers must be written in captitals, i. e. A,B,C,D,E and F.

Example: Reading parameter 1 of channel 1

character no.	1	2	3	4	5	6	7	8	9	10
HEX value	3E	30	31	4B	50	30	31	35	44	0D
ASCII character	**>**	**0**	**1**	**K**	**P**	**0**	**1**	***5***	***D***	**<CR>**

CHECKSUM calculation = adding the HEX-values of characters 2 to 7
30h + 31h + 4Bh + 50h + 30h + 31h = 1**5D**

Example: Reading measuring value B1 (scaled actual value) of channel 2

character no.	1	2	3	4	5	6	7	8	9	10
HEX value	3E	30	32	4B	4D	42	31	36	44	0D
ASCII character	**>**	**0**	**2**	**K**	**M**	**B**	**1**	***6***	***D***	**<CR>**

CHECKSUM calculation = adding the HEX values of characters 2 to 7
30h + 32h + 4Bh + 4Dh + 42h + 31h = 1**6D**

Answere to a Read Request

The MCM 200 will send the requested measuring values or parameter values in the following format:

<START CHARACTER> <DATA TYPE> <DATA> <CHECKSUM> <CR>

- start character: ..... always 'A' (in case of any errror the MCM 200 sends 'N' followed by an error no.)
- data type:..... there are 4 different types :
  'l' = LONG : 4 datenbytes (8 characters) MSB...LSB
  'i' = INTEGER: 2 datenbytes (4 characters) MSB, LSB
  'b' = BYTE : 1 datenbyte (2 characters)
  'f' = FLOAT 4 datenbytes (8 characters) MSB...LSB, format DIN-IEC 47B(C0)2
  The data type for each parameter or measuring value is preset (see table) and indicated in each answer.
- data: ..... in accordance with the data type the databytes containing the results of the request are transmitted
- checksum: ..... a *2 digit hexadecimal number* reflecting the sum of all preceding characters, except for the start character. The sum is calculated by adding all hex values. The low-byte of the results (also use 2 ASCII characters to indicate a HEX number) is the checksum
- CR: ..... each answer is completed with the carriage return character (Hex value 0D)

Example: Answer to the request >02KMB1<CHECKSUM><CR>

character no.	1	2	3	4	5	6	7	8	9	10	11	12	13
HEX value	41	66	34	32	35	42	43	35	34	37	31	32	0D
ASCII character	**A**	**f**	**4**	**2**	**5**	**B**	**C**	**5**	**4**	**7**	***2***	***6***	**<CR>**

The MCM replies with the character 'A', i. e. no fault found. (You should now calculate the checksum of the incoming characters, character position 2 to position <CR>-3, and convert it into the ASCII-code. If your result does not equal the checksum received, there is a transmission error).
The start character is followed by the data type character 'f' (=float) and the databytes in MSB...LSB order.

The application software must now sift out the databytes, perform a ASCII-HEX-conversion and convert the result in accordance with the datatype.

The measuring value received in this example is 425BC547 h ➔ 54,94 d.

>A**f425BC547**<CHKSUM><CR>
 | these characters are required to calculate the checksum

Write Request String

The request string contains the following:

<START CHARACTER> <CHANNEL NO.> <COMMAND> <SECTION> <ADDRESS> <FORMAT> <DATA> <CHECKSUM> <CR>

- channel no.: .....a *2 digit hexadecimal number* specifying the measuring channel to communicate with. The HEX number is shown in ASCII characters (channel 5 ➔ '05')
- command: .....'J' for write request
- section: .....The MCM 200 has two sections: parameter and measuring value section ASCII character 'P' selects parameters, measuring values are not available with write requests
- address:.....a *2 digit hexadecimal number* specifying the parameter or measuring value number toc contact. The HEX number is shown in ASCII characters.
- format: .....enter the format of the parameter, there are 4 different types:
  'l' = LONG : 4 datenbytes (8 characters) MSB...LSB
  'i' = INTEGER: 2 datenbytes (4 characters) MSB, LSB
  'b' = BYTE : 1 datenbyte (2 characters)
  'f' = FLOAT 4 datenbytes (8 characters) MSB...LSB, format DIN-IEC 47B(C0)2
  The data type for each parameter is preset (see table).
- data:.....in accordance with the data type the databytes containing the results of the request are transmitted
- checksum:.....a *2 digit hexadecimal number* reflecting the sum of all preceding characters, except for the start character. The sum is calculated by adding all hex values. The low-byte of the results (also use 2 ASCII characters to indicate a HEX number) is the checksum
- CR:.....each request string has to be completed with the Carriage Return-character (hexvalue 0D) as the MCM 200 will only start a log check on receipt of this character.

  Please note: HEX numbers must be written in captitals, i. e. A,B,C,D,E and F.

Example: Writing the set point of channel 1 (datatype = float)

character no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
HEX value	3E	30	31	4A	50	42	44	66	34	37	33	33	46	32	31	35	39	36	0D
ASCII charac.	**>**	**0**	**1**	**J**	**P**	**B**	**D**	**f**	**4**	**7**	**3**	**3**	**F**	**2**	**1**	**5**	***9***	***6***	**<CR>**

CHECKSUM calculation = adding the HEX values of characters 2 to 16
30h + 31h + 4Ah + 50h + 42h + 44h + 66h + 34h + 37h + 33h + 33h + 46h + 32h + 31h + 35h = 3**96**

Answer to a Write Request

On each successful write request the MCM 200 will return a message of the following format:

character no.	1	2	5
HEX value	41	77	0D
ASCII character	**A**	**w**	**<CR>**

Faulty Read or Write Requests

The MCM will return an error message if it cannot reply to a read/write request or if errors in syntax are found (provided that the requested module is included in the data network). The error message looks as follows:

character no.	1	2	3	4
HEX value	4E	77	42	0D
ASCII character	**N**	**x**	***x***	**<CR>**

Error numbers and their respective meaning can be taken from the table below. If an answer to a request starts off with 'N', the error number may help to find the problem.

Error Table

MCM 200 answers to a read or write request starting off with 'N' are followed by a 2 digit number which describes the kind or origin of an error as listed below:

log error	N10	start character '>' missing
	N11	inadmissible command: only 'J' or 'K' admissible
	N12	inadmissible section: only 'M' or 'P' admissible
	N13	inadmissible request: write not allowed for measuring values, only read
	N14	data type error with write request ('f','i','b','l') after parameter no.
	N15	false no. of bytes in request string (read)
	N16	false no. of bytes in request string (write float/long)
	N17	false no. of bytes in request string (write integer)
	N18	false no. of bytes in request string (write byte)
data error	N21	HEX error in parameter no. (only capitals)
	N22	HEX error in parameter data
	N23	HEX error in checksum received
	N24	CHECKSUM error: checksum calculatated and received are different
internal errors	N90	manipulated RECEIVE buffer/illegal
	N91	false data format by MCM
	N92	MCM states Nxx error code (internal communication)
	N93	undefined error: MCM states neither 'A' nor 'N'
	N94	address (MCM internal) cannot answer (➔ time out communication)

ASCII Conversion Table

ASCII character	HEX value/ decimal	ASCII character	HEX value/ decimal	ASCII character	HEX value/ decimal
0	30 / 48	A	41 / 65	b	62 / 98
1	31 / 49	B	42 / 66	f	66 / 102
2	32 / 50	C	43 / 67	i	69 / 105
3	33 / 51	D	44 / 68	l	6C / 108
4	34 / 52	E	45 / 69	>	3E / 62
5	35 / 53	F	46 / 70	w	77 / 119
6	36 / 54	J	4A / 74	N	4E / 78
7	37 / 55	K	4B / 75		
8	38 / 56	P	50 / 80	<LF>	0A / 10
9	39 / 57	M	4D / 77	<CR>	0D / 13

List of Parameters and Measuring Values MCM 200

Para No. HEX	Data type	read/ write	Description
00	byte	r	**Ratio Calculation Mode / Quick-Programming** Bit 7 6 5 4 3 2 1 0 0 0--ratio of actual value 0 1--ratio of pulse preset 1 0--ratio with ext. Contact ^ -------1 = quick-prog.density ^-----------1 = quick-prog.limits ^-------------1 = quick-prog.setpoint ^-----------------1 = quick-prog.ideal ratio ^---------------------1 = quick-prog.Main ^-----------------------1 = quick-prog.general
01	byte	r	test register to detect battery defects
02	byte	r	**MCM Options:** Bit 7 6 5 4 3 2 1 0 ^--1 = interface RS/centronics ^-----1 = analogue IN channel A ^ -------1 = linearisation channel A ^-----------1 = controller channel A ^-------------1 = measuring channel B ^-----------------1 = analogue IN channel B ^---------------------1 = linearisation channel B ^-----------------------1 = controller B
03	byte	r	**module offset** - if several MCM's are connected in a network, a module offset has to be programmed for each unit (see programming)
04	byte	r	**baudrate of the serial interface** 0 = 2400 Bd / 1 = 4800 Bd / 2 = 9600 Bd
06	byte	r	**limit 1 operation mode** bit 0 to 3 specify the mode of the limit 0 = flow limit A / 1 = flow limit B / 2 = flow limit A+B / 3 = sum limit A 4 = sum limit B / 5 = sum limit A+B / 6 = ratio limit A/B 7 = analog in limit A / 8 = analog in limit B / 9 = controller A-setpoint/act. Limit 10 = controller B setpoint/act. Limit bits 6 and7 specifiy the limit status of the respective output: bit 6 = 1 : MIN limit 1 active Bit 6 = 0 : MIN limit 1 inactive Bit 7 = 1 : MAX limit 1 active Bit 7 = 0 : MAX limit 1 inactive
07	byte	r	**limit 2 operation mode** (for specifications see parameter 06)
08	byte	r	**limit 3 operation mode** (for specifications see parameter 06)
09	byte	r	**limit 4 operation mode** (for specifications see parameter 06)
0A	byte	r	**limit 5 operation mode** (for specifications see parameter 06)
0B	byte	r	**limit 6 operation mode** (for specifications see parameter 06)
0C	byte	r	**display dimensions analogue input** (bits 0 to 3) 0 = l/min 1 = kg/min 2 = ccm/min 3 = g/min 4 = l/h 5 = kg/h 6 = ccm/s 7 = g/s 8 = Gal/min 9 = lb/min A = m^3/h B = U/min C = °C D = bar E = kg/m^3 F = A/B

Para No. HEX	Data type	read/ write	Description
OE	byte	r	**analogue in- and output (offset/response time)** bit 0 = offset output: 0 = 0 mA , 1 = 4 mA bit 1 = response time output: 0 = fast , 1 = slow bit 2 = offset input: 0 = 0 mA , 1 = 4 mA bit 3 = response time input: 0 = fast , 1 = slow bit 4, 5 = analogue input mode: 00 = meas. input with individual dimension 01 = setpoint input controller (flow dimension)
10	byte	r	**decimal points (analogue input, total, flow)** A decimal point position between 0 and 3 may be selected for each of the 3 scaling factors (1/1, 1/10, 1/100, 1/1000). 2 bits in this register are used for each factor (binar y notation): bits 0 and 1: flow decimal point bits 2 and 3: total/sum decimal point bits 4 and 5: analogue input decimal point
12	byte	r	**flow- and total/sum dimension** bits 0 to 3 state the flow dimension: 0 = l/min 1 = kg/min 2 = ccm/min 3 = g/min 4 = l/h 5 = kg/h 6 = ccm/s 7 = g/s 8 = Gal/min 9 = lb/min A = m³/h B = U/min C = °C D = bar E = kg/m³ F = A/B bits 4 to 7 state the total/sum dimension: 0 = kg 1 = gramm 2 = litres 3 = ccm 4 = pulses 5 = galones 6 = lb 7 = m³ 8 = U
14	byte	r	**multi-functional control register** bit 7 6 5 4 3 2 1 0 | | | | | | | | | | | | | 0 0 0--measuring module mode | | | | | 0 0 1--contrl. w/t fix setp. | | | | | 0 1 0--contrl. w/t ext. fix setp. | | | | | 0 1 1--contrl. ratio fix setp. | | | | | 1 0 0--contrl. ext.ratio fix setp. | | | | | 1 0 1--contrl. w/t analogue setp. | | | | | 0 1 1--contrl. w/t anal.ratio setp. | | | | ^----------1 = hold control output | | | ^--------------1 = keyreset active | | ^------------------1 = ctrl. type 1, 0 = type 0 | ^--------------------1 = linearisation active ^------------------------1 = flow limit delayed
16	byte	r/w	**printer -> MCM device no.:** This number appears on the printout (measuring values/parameters)
17	byte	r/w	**printer -> printer log measuring values** 0 = parameter printout (list of all operation parameters) 1 = specific printout of meas. values (programmable, see manual) 3 = standard printout of meas. values (all operation values)
18	byte	r/w	**hysteresis limit 1** in 1/10 % (without decimal point) adjust switch hysteresis of the respectve output here
19	byte	r/w	**hysteresis limit 2** in 1/10 % (without decimal point)
1A	byte	r/w	**hysteresis limit 3** in 1/10 % (without decimal point)
1B	byte	r/w	**hysteresis limit 4** in 1/10 % (without decimal point)
1C	byte	r/w	**hysteresis limit 5** in 1/10 % (without decimal point)
1D	byte	r/w	**hysteresis limit 6** in 1/10 % (without decimal point)

List of Parameters and Measuring Values MCM 200 (continued)

Para No. HEX	Data type	read/ write	Description
1E	byte	r/w	**measuring value printout line 1** with specific printout (requires programming): 00: actual value A in flow dimension 01: actual value B in flow dimension 02: actual value A+B in flow dimension 03: actual value A-B in flow dimension 04: actual value A/B as ratio value (x.xxx no dimension) 05: sum A in total dimension 06: sum B in total dimension 07: sum A+B in total dimension 08: sum A-B in total dimension 09: sum A/B as ratio value (x.xxx no dimension) 0A: total A in total dimension 0B: total B in total dimension 0C: analogue input A in analog-IN dimension 0D: analogue input B in analog-IN dimension 0E: limit status for limits 1 to 6 (ON/OFF) 0F: this is the final line
	byte	r/w	**measuring value printout line** with specific printout (requires programming): see parameter 1E
20	byte	r/w	**measuring value printout line 3** with specific printout (requires programming): see parameter 1E
21	byte	r/w	**measuring value printout line** with specific printout (requires programming): see parameter 1E
22	byte	r/w	**measuring value printout line** with specific printout (requires programming): see parameter 1E
23	byte	r/w	**measuring value printout line** with specific printout (requires programming): see parameter 1E
24	byte	r/w	**measuring value printout line 7** with specific printout (requires programming): see parameter 1E
25	byte	r/w	**measuring value printout line 8** with specific printout (requires programming): see parameter 1E
26	byte	r/w	**measuring value printout line 9** with specific printout (requires programming): see parameter 1E
27	byte	r/w	**measuring value printout line 10** with specific printout (requires programming): see parameter 1E
28	byte	r/w	Each of the next 20 bytes contains one character. This character chain is included in the printer log. The characters have to be programmed individually. **print text character 1**
29	byte	r/w	**print text character 2**
2A	byte	r/w	**print text character 3**
2B	byte	r/w	**print text character 4**
...	byte	r/w	**print text character ...**
3A	byte	r/w	**print text character 19**
3B	byte	r/w	**print text character 20**
3F	byte	r/w	linearity error: bit 0 to 6 contain the error in 1/10 % (±12.5%) , bit 7 represents the sign of the error (0 = positive/1 = negative) **linearity error point 1**
40	byte	r/w	**linearity error point 2**
41	byte	r/w	**linearity error point 3**
42	byte	r/w	**linearity error point 4**

Para No. HEX	Data type	read/ write	Description
43	byte	r/w	**linearity error point 5**
44	byte	r/w	**linearity error point 6**
45	byte	r/w	**linearity error point 7**
46	byte	r/w	**linearity error point 8**
47	byte	r/w	**linearity error point 9**
48	byte	r/w	**linearity error point 10**
53	byte	r/w	**gate time** for frequency measurement (value x 104ms)
55	byte	r/w	**proportional factor of the PI-controller**
57	byte	r/w	**integral factor of the PI-controller**
59	byte	r/w	**controlling difference of the PI-controller** bits 0 to 6 contain the percentual controlling difference in 1/10 % (±12.5%) , bit 7 represents the sign of the error (0 = positive/1 = negative)
66	integer	r/w	**printout counter for the parallel printer** (0-65535)
67	integer	r/w	**pulse preset for ratio calculation** at corresponding ratio mode
68	integer	r/w	**limit-wait-time** (this value multiplicated by 13 ms = delay)
69	integer	r/w	linearisation frequency point in Hz (integer values only) **linearisation frequency point 1**
6A	integer	r/w	**linearisation frequency point 2**
6B	integer	r/w	**linearisation frequency point 3**
6C	integer	r/w	**linearisation frequency point 4**
6D	integer	r/w	**linearisation frequency point 5**
6E	integer	r/w	**linearisation frequency point 6**
6F	integer	r/w	**linearisation frequency point 7**
70	integer	r/w	**linearisation frequency point 8**
71	integer	r/w	**linearisation frequency point 9**
72	integer	r/w	**linearisation frequency point 10**
83	integer	r/w	**density** in kg/m³ (without decimal point)
85	integer	r/w	**valve correction time of PI controller** (value multiplicated by 13 ms = valve correction time)
8C	long	r/w	**MAX limit 1** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
8D	long	r/w	**MAX limit 2** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
8E	long	r/w	**MAX limit 3** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
8F	long	r/w	**MAX limit 4** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
90	long	r/w	**MAX limit 5** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
91	long	r/w	**MAX limit 6** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
92	long	r/w	**MIN limit 1** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
93	long	r/w	**MIN limit 2** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
94	long	r/w	**MIN limit 3** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)

List of Parameters and Measuring Values MCM 200 (continued)

Para No. HEX	Data type	read/ write	Description
95	long	r/w	**MIN limit 4** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
96	long	r/w	**MIN limit 5** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
97	long	r/w	**MIN limit 6** (to set this value the limit mode (P06), the dimension in accordance with the limit mode and the associated decimal point must be known)
98	long	r/w	**ideal ratio** format A/B x 1000; Example: for an ideal ratio of 1.567 enter 1567
9B	long	r/w	**PI-controller fixed setpoint** (standard or ratio): *Standard setpoint*: enter the setpoint considering the flow dimension (bits 0 to 3 of P12) and the decimal point of the flow display (bit 0/1 of P10). Example: Flow-DP = 2, flow dimension = l/min, setpoint = 234.56 l/min controller setpoint = 23456 d *Ratio setpoint*: enter the desired ratio as follows: ratio x 1000 Example : for desired ratio of 1.523 enter 1523
9D	long	r/w	**analogue input final value** considering analogIn dimension (bits 0 to 3 of P0C) and analog IN decimal point (bit 4/5 of P10). Example: analog IN dimension = bar, analog IN DP = 2, final value = 23.45bar enter 2345 d
9F	long	r/w	**analogue output final value** considering the flow dimension (bits 0 to 3 of P12) and the flow DP (bit 0/1 of P10) - only for measuring module, otherwise the analogue output is used as set output for the PI controller. Example : flow dimension = l/min, flow DP = 2, final value = 23.56 l/min enter 2356 d
A1	long	r/w	**analogue output start value** considering the flow dimension (bits 0 to 3 of P12) and the Flow DP (bit 0/1 of P10) - only for measuring module, otherwise the analogue output is used as set output for the PI controller. Example: flow dimension = l/min, flow DP = 2, start value = 4.32 l/min enter 432 d
A3	long	r/w	**K-factor of the flow meter** in pulses/litre with 2 decimal digits Example: with K-factor flow meter = 2345.76 pulses/liter enter 234576 d
AA	float	r	**ratio**: here you will find the actual ratio calculation of channel A/B as floating point value
AD	float	r	**scaled sum value** in the adjusted dimension as floating point value
AF	float	r	**scaled totaliser** in the adjusted dimension as floating point value
B1	float	r	**scaled actual value** in flow dimension as floating point value
B3	float	r	**direct measuring frequency** in Hz as floating point value (without gate time)
B5	float	r	**sampled measuring frequency** in Hz as floating point valuet (witht gate time)
B7	float	r	**actual setpoint frequency** in Hz (PI-controlller) as floating point value
B9	float	r	**scaled analogue input value** (in analogue dimension) as floating point value
BD	float	r	**actual setpoint** in flow dimension as floating point value
BF	float	r	**flow meter pulses of the sum counter** as floating point value
C1	float	r	**flow meter pulses of the totaliser** as floating point value